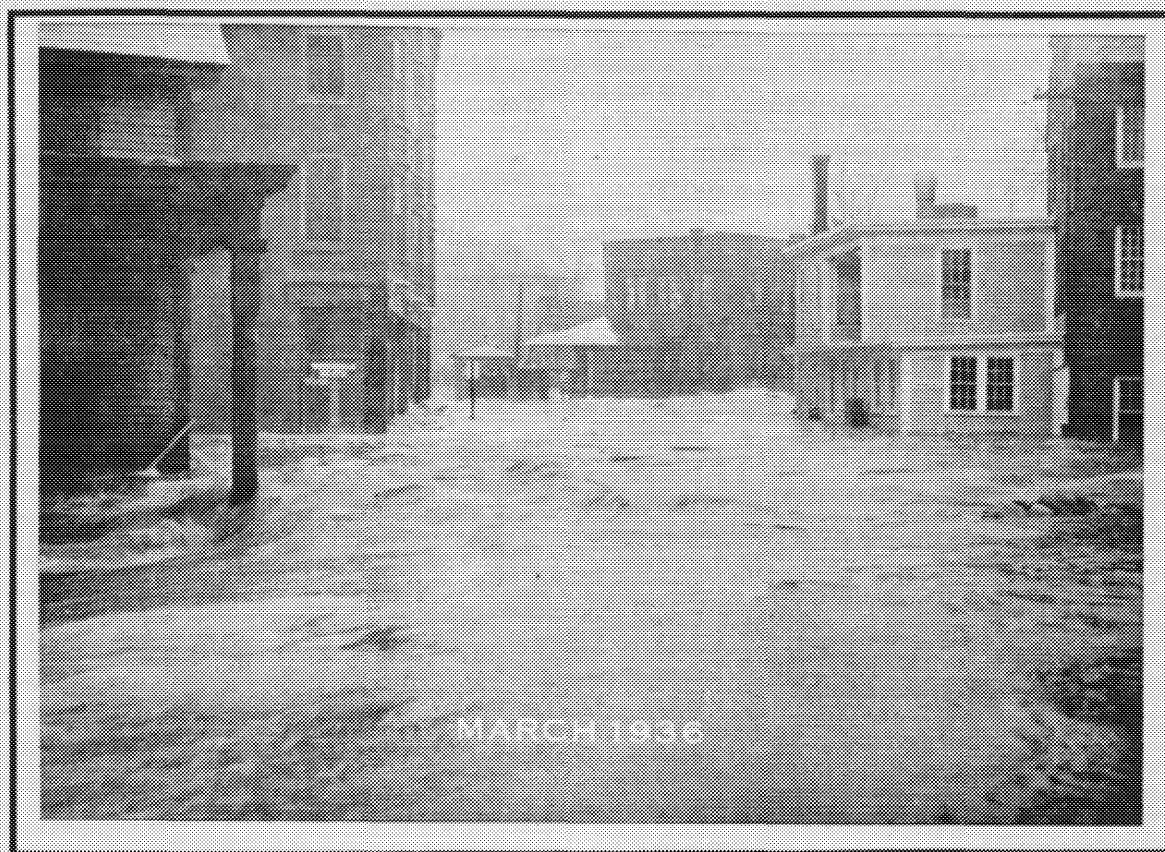


FLOOD PLAIN INFORMATION

NORTH NASHUA RIVER
FITCHBURG AND LEOMINSTER
MASSACHUSETTS



PREPARED BY THE DEPARTMENT OF THE ARMY, NEW ENGLAND DIVISION,
CORPS OF ENGINEERS, WALTHAM, MASSACHUSETTS

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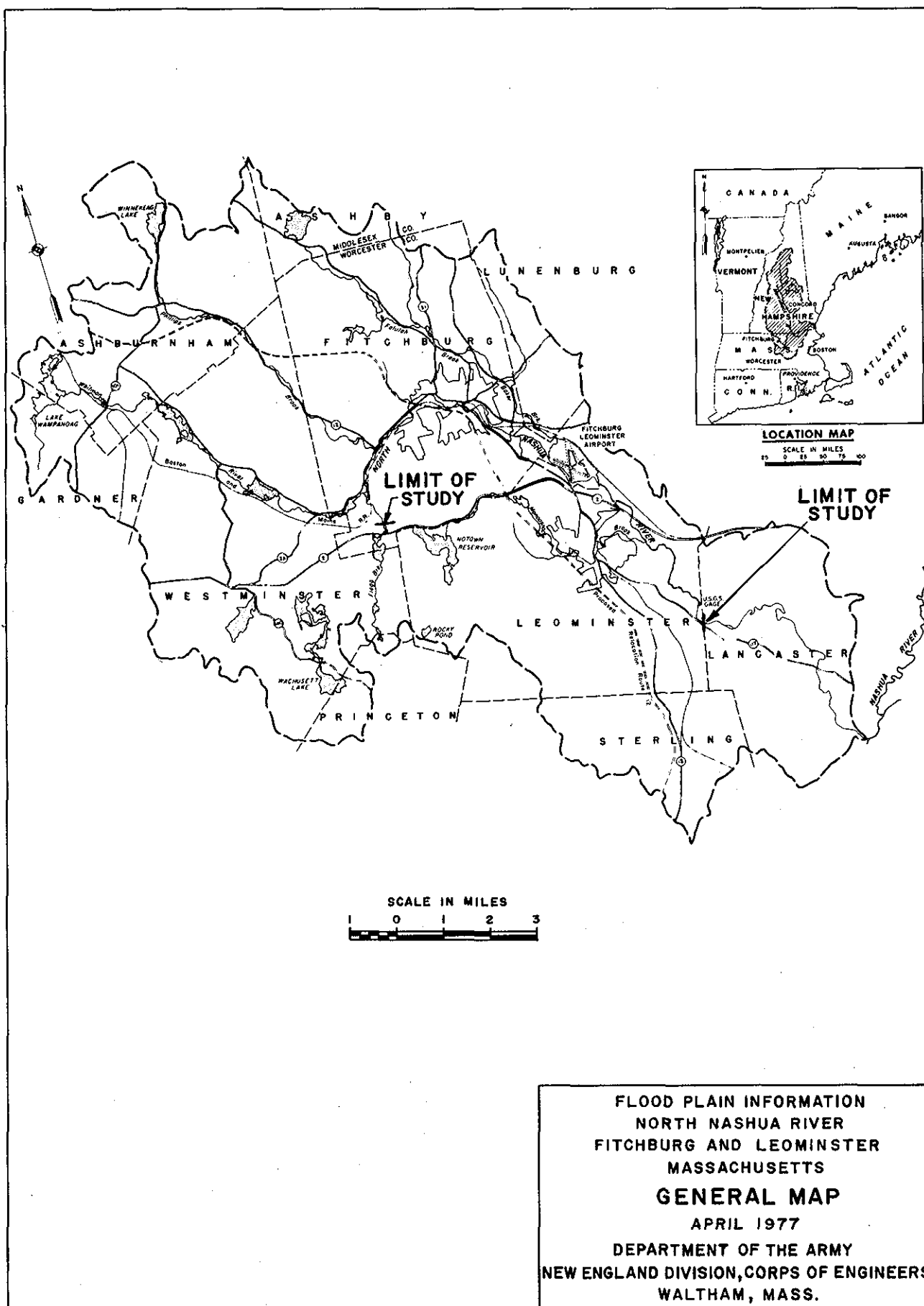
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PREFACE

The portions of Fitchburg and Leominster covered by this report are subject to flooding from the North Nashua River. The properties along the river and its tributaries are primarily industrial, with some commercial, residential and agricultural. They have been severely damaged by the floods of March 1936 and September 1938. The open spaces in the flood plains which may come under pressure for future development are limited. Although large floods have occurred in the past, studies indicate that even larger floods are possible.

This report has been prepared because a knowledge of flood potential and flood hazards is important in land use planning of flood plains. It includes a history of flooding on the North Nashua River in Fitchburg and Leominster and identifies those areas that are subject to possible future floods. Special emphasis is given to these floods through maps, photographs and profiles. The report does not provide solutions to flood problems; however, it does furnish a suitable basis for the adoption of land use controls to guide flood plain development and thereby prevent intensification of the loss problems. It will also aid in the identification of other flood damage reduction techniques such as works to modify flooding and adjustments, including flood proofing, which might be embodied in an overall Flood Plain Management (FPM) program. Other FPM program studies -- those of environmental attributes and the current and future land use role of the flood plain as part of its surroundings -- would also profit from this information.

This report was prepared at the request of the cities of Fitchburg and Leominster, by the Corps of Engineers, New England Division, under continuing authority provided in Section 206 of the 1960 Flood Control Act (Public Law 86-645), as amended.

Assistance and cooperation of individuals, the U.S. Geological Survey, the Massachusetts Department of Public Works, the cities of Fitchburg and Leominster and others that have contributed to the preparation of this report are appreciated.

Additional copies of this report may be obtained from the cities of Fitchburg and Leominster. The Corps of Engineers, New England Division, upon request, will provide technical assistance to planning agencies in the interpretation and use of the data presented as well as planning guidance and further assistance, including the development of additional technical information.

BACKGROUND INFORMATION

Settlement

Fitchburg was first settled about 1730 and was incorporated as a town in 1764. For nearly fifty years after its incorporation, Fitchburg was primarily a self contained dairying and agricultural community. In 1793, a Boston to Fitchburg stage line opened and new industrial potentials were recognized.

The opening of the Boston and Fitchburg Railroad in 1845 and the Vermont and Massachusetts Railroad in 1848 insured rapid transportation facilities and attracted new industries. Granite quarrying at Rollstone Hill is still an important industry. Current major products include paper and allied products, superchargers, saws, men's and boy's clothing, women's handbags, firearms, toys and hardware. Today, Fitchburg is an industrial city in the Fitchburg-Leominster Standard Metropolitan Statistical Area, a trade center for surrounding communities and the site of a State College.

The history of Leominster begins with that of Lancaster. The original grant for Lancaster in 1643 included the present towns of Lancaster, Clinton, part of Bolton, Harvard and Sterling. In 1701, the land to the northwest was purchased from Chief Sholan of the Nashua Indians.

By 1737, the residents of the New Grant section of Lancaster decided they could govern themselves more cheaply and more conveniently. Their petition to separate was granted by the General Court on July 4, 1740 and Leominster history began.

The boundaries of Leominster were changed in 1838. Unincorporated land known as No Town, surrounded by Fitchburg, Leominster, Princeton and Westminster was divided up between the last three towns.

Leominster started as a farming community but entered the industrial era about 1770 when Obadia Hills began making horn combs in his kitchen. By 1845, twenty-four comb factories were in operation. Until the great depression of the 1930's, Leominster manufactured more than seventy percent of the piano cases made in the

country. Today, Leominster advertises itself as the "Pioneer Plastic City". Local products include plastic products, rubber goods, apparel, paper products, non-electrical machinery and chemical products.

The Streams and Their Valleys

The North Nashua River originates at the confluence of the Whitman River and Flag Brook in Fitchburg and flows through the cities of Fitchburg and Leominster to its confluence with the Nashua River in Lancaster, Massachusetts. The Whitman River and Flag Brook have drainage areas of 27.5 and 12 square miles, respectively. The drainage area of the North Nashua River at the USGS gage, located just upstream of the Leominster-Lancaster line, is approximately 107 square miles. The principal tributaries of the North Nashua River within the study area are as follows: (1) Monoosnoc Brook; (2) Falulah-Baker Brook; and (3) Phillips Brook. (See Index Map - Plate 2).

Monoosnoc Brook rises in Rocky Pond in the hills west of the city of Leominster and flows in a general easterly direction for 8.7 miles through the business center of Leominster to its confluence with the North Nashua River, about nine miles upstream of the junction of the North Nashua and Nashua Rivers. The drainage area at the mouth of the brook is 11.5 miles. The brook has a total fall of about 550 feet.

Falulah Brook joins Baker Brook at Pearl Hill Brook about 2.5 miles above the North Nashua River confluence near the Fitchburg-Leominster Airport. Baker Brook has a total drainage area of 20 square miles, of which 11 square miles are drained by Falulah Brook and four square miles by Pearl Hill Brook.

Phillips Brook has its source in Winnekeag Lake (elevation 1,126 feet, msl) in the town of Ashburnham and flows generally southward for a distance of eight miles to its confluence with the North Nashua River. It has a drainage area of 15.9 square miles and a total fall of about 600 feet. Drainage areas contributing to runoff at locations in or near the study area are shown in Table 1.

TABLE 1
DRAINAGE AREAS

<u>Location</u>	<u>Drainage Area</u> (sq. miles)
Monoosnoc Brook	11.5
Flag Brook	12.0
Phillips Brook	15.9
Falulah-Baker Brook	20.0
Whitman River	27.5
North Nashua River at USGS Gage	107.0

The North Nashua River watershed is quite hilly and conducive to rapid runoff. In the reach through the study area, the river itself falls 375 feet in a distance of 13.5 miles for an average slope of 27.8 feet per mile. There are numerous reservoirs within the watershed which have a modifying effect on flood development. The modifying effect of these reservoirs is greatest for minor storm events and becomes less during greater storm events.

The climate of the Fitchburg-Leominster area is characterized by moderately warm summers when temperatures may occasionally rise above 100°F, and cool winters when temperatures may infrequently reach lows in the -20°F. The average annual precipitation of the area is about 42 inches, occurring rather uniformly throughout the year. Snowfall throughout the area usually averages between 55 and 60 inches per year.

Developments in the Flood Plain

The land in or near the flood plains of the North Nashua River and its tributaries includes residential, municipal, industrial, and mercantile developments.

In recent years, there has been a great deal of paving and filling of the area's wetlands, and rapid development along the North Nashua River and its tributaries has occurred. The resulting increased runoff rates in combination with the loss of non-damaging flood plain storage has resulted in an increased flood problem potential. Future developments along or adjacent to the flood plains, if continued and if accomplished injudiciously, would only tend to increase the magnitude and frequency of flooding.

Downtown Fitchburg has a large concentration of residential, commercial and mercantile properties along the river, while downstream of this area there are only scattered dwellings and factories along its flood plains. The flood plains along the tributaries to the North Nashua River also contain high concentrations of residential and mercantile buildings. Large areas such as Fitchburg State College, the Wallace Civic Center, the John Fitch Shopping Center, and numerous residences and small businesses are located along Falulah-Baker Brook.

There are numerous dams on the North Nashua River and its tributaries within the study area. Table 6 lists these dams along with pertinent information.

The population of Fitchburg, based on the 1970 census, is 43,343. This is less than a one percent increase over the 1960 census figure of 43,021. The population of Leominster, also based on the 1970 census, is 32,430, a sixteen percent increase over the 1960 census figure of 27,929.

Sources of Data and Records

The U.S. Geological Survey has recorded flows on the North Nashua River at Leominster, Massachusetts since 1936. The location of the gage is shown on Plate 2. The five greatest flows recorded at this station are shown in Table 2.

In the 1965 Water Resource Development Plan for the Nashua River Basin, the Corps of Engineers determined discharge frequencies of the North Nashua River using recorded flows at Leominster in a Log Pearson Type III distribution. The completed discharge frequencies at the gaging station are listed in Table 3.

TABLE 2

FLOOD DISCHARGE DATA
(At USGS Gaging Station)
Leominster, Massachusetts

<u>Date</u>	<u>Discharge</u> (cfs)
March 18, 1936	16,300
September 21, 1938	10,300
October 15, 1955	8,870
June 25, 1944	8,100
September 11, 1954	5,800

TABLE 3

DISCHARGE FREQUENCIES
(At USGS Gaging Station)
Leominster, Massachusetts

<u>Frequency</u> (years)	<u>Discharge</u> (cfs)
SPF	24,000
100 Year	18,000
50 Year	13,000
20 Year	9,200
10 Year	6,600
5 Year	4,500

Discharge frequencies were subsequently developed at other locations in the basin, based on an analysis of watershed characteristics and the computed data at the Leominster gage.

Table 4 lists key locations in the study area and includes the pertinent discharges used for the purpose of flood plain delineation.

TABLE 4

PEAK FLOWS FOR FIFTY AND ONE HUNDRED YEARS AND
STANDARD PROJECT (SPF) FLOODS

<u>Location</u>	<u>Station</u> ¹ (feet)	<u>Drainage</u> <u>Area</u> (sq. mi.)	<u>50Yr.</u> (cfs)	<u>100Yr.</u> (cfs)	<u>SPF</u> (cfs)
<u>North Nashua River at</u>					
Leominster-Lancaster Town Line	0+00	10.7	13,000	18,000	24,000
Monoosnoc Brook	158+50	11.5	12,500	16,500	22,000
Baker Brook	334+50	20.0	12,000	15,000	20,000
Phillips Brook	622+50	15.9	8,000	11,000	14,000

¹Distance from Leominster-Lancaster town line, measured along North Nashua River.

FLOOD SITUATION

Flood Season and Flood Characteristics

Floods have occurred on the North Nashua River during all seasons of the year. Floods develop very quickly in the North Nashua due to the hilly topography of its watershed. The floods in the watershed usually peak between 12 and 24 hours, depending on the continuation of precipitation and antecedent runoff conditions.

In addition to flooding caused by runoff from general rainfall, the North Nashua River basin is susceptible to hurricane activity. However, the main flood season is in the spring when snowmelt combines with rainfall.

Factors Affecting Flooding and Its Impact

Obstructions to Floodflows -- Natural obstructions to floodflows include trees, brush and other vegetation growing in and along the streams in floodway areas. Man-made encroachments over the streams such as dams, bridges and culverts can also create more extensive flooding than would otherwise occur.

During floods, trees, brush and other debris may be washed away and carried downstream to collect on bridges and other obstructions. As floodflow increases, masses of debris break loose and a wall of water and debris surges downstream until another obstruction is encountered. Debris may collect against a bridge until the load exceeds its structural capacity and the bridge is destroyed. The limited capacities of obstructive bridges retard floodflows and result in flooding upstream. This increased flooding contributes to eroding around bridge approach embankments and damage to overlying roadbeds.

In general, obstructions restrict floodflows and cause overbank flooding, destruction of or damage to bridges, and an increased velocity of flow immediately downstream. It is impossible to predict the degree or location of accumulation of debris or ice at any channel obstruction in the development of the flood profiles.

Additionally, the enlargement of a restrictive stream crossing, increasing flow capacity, tends to decrease flood stages and inundated

areas upstream of the crossing, but could increase flood stages and flooded areas downstream. Therefore, the results of any Flood Plain Information Report should be reviewed periodically by appropriate state and local officials and planners to determine if changed watershed conditions significantly affect the results of the study.

Nine railroad bridges, 27 vehicular bridges, a foot bridge and 11 dams are on the North Nashua River, along with one culvert, one railroad bridge, two vehicular bridges and one dam on Flag Brook. The culvert, 16 vehicular bridges and six railroad bridges are considered to be obstructive to floodflows. Pertinent data on these man-made obstructions can be found in Table 5. Figures 1 through 4 show representative structures that are obstructive to floodflows.

Flood Damage Reduction Measures -- Following the 1936 flood along the North Nashua River, the U.S. Army Corps of Engineers spent about 1.4 million dollars in improvements for the river. They include channel enlargement and realignment, removal of dams, dike construction, riprapping, underpinning of structures, construction of retaining walls and a diversion conduit, and reconstruction of a railroad trestle. There has been considerable deterioration of the protective system since completion of the project.

Both Fitchburg and Leominster presently have zoning ordinances and other regulatory measures specifically designed to govern the use of flood plains and to reduce flood damage. The state requires that no person shall remove, fill or dredge any bank, flat, marsh, meadow, or swamp bordering on an inland waterway without filing written notice of intention to do so with the city or town concerned, the State Department of Public Works, and the State Department of Natural Resources.

Other Factors and Their Impacts -- Over the years there has been considerable loss of natural storage capacity within the study area due to the construction of roads, industrial plants, shopping centers, schools, etc. Even residential buildings have been spreading to such an extent that they have eliminated a large part of the non-damaging flood plains. When this is combined with the deterioration of the river channel and sedimentation throughout the length of the river, it reveals an increasing flood potential. Paving of the watershed in the form of roads and parking lots adversely affects the flood plain by decreasing the amount of absorption by the ground and increasing the runoff rate.

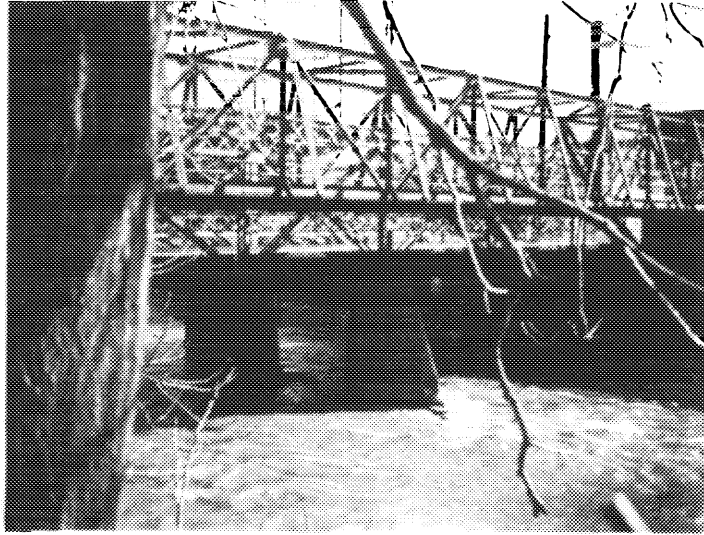


FIGURE 1 - Boston and Maine Railroad Bridge at Station 372+40. The large number of piles can pose potential obstruction to floodflows by snagging floating debris.



FIGURE 2 - Footbridge and Private Road at Station 449+25. Showing low hanging truss and bank overgrowth.

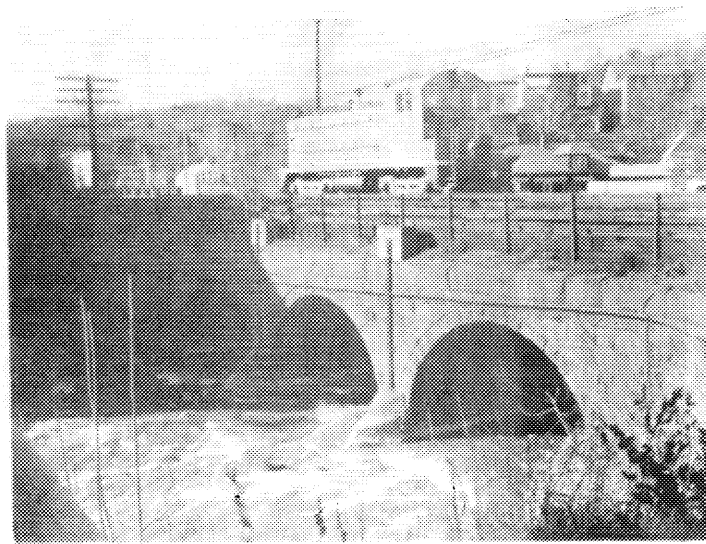


FIGURE 3 - Boston and Maine Railroad Bridge at Station 554+00.



FIGURE 4 - Fifth Massachusetts Turnpike Bridge at Station 716+50.
Showing low steel.

Flood Warning and Forecasting -- The U. S. Department of Commerce, National Weather Service, is responsible for forecasting high water on the nation's rivers and for issuing flood warnings for the protection of life and property. The National Weather Service, in Portland, Maine is responsible for issuing flood warnings for the Merrimack River Basin. The flood warnings are issued simultaneously to the press service, state police, civil defense, and many other state and local agencies.

On the local level, the civil defense directors for both Fitchburg and Leominster are notified of impending floods or other natural disorders by their sector director, located in Tewksbury, Massachusetts. This can usually be done by telephone. However, there is a fire radio net and state police net, both of which can transmit timely warnings and information. Both of these nets are manned 24 hours per day. Local inhabitants, industry, business and others are alerted by telephone calls made by civil defense volunteers, fire sirens, or by messengers if necessary. Both civil defense directors have standard operating procedures for this operation.

Flood Fighting and Emergency Evacuation Plans -- The civil defense directors of Fitchburg and Leominster have formal flood fighting and emergency evacuation plans detailing measures to be taken in the event floods occur. These plans place the responsibility for rescue work with the fire departments of each city. The civil defense transportation officers of both cities have boats and buses at their disposal, if needed.

Material Storage on the Flood Plain -- Flood hazards are intensified by floatable materials collecting against bridges or plugging culverts and obstructing the passage of floodflows. The commercial, industrial and residential uses of flood plains in the study area could result in the accumulation of significant amounts of floatable materials. During times of floods, these floatable materials may be carried away by floodflows, causing serious damage to structures downstream and could clog bridge openings creating more hazardous flooding problems.

PAST FLOODS

Summary of Historical Floods

Damaging floods are known to have occurred in the North Nashua River watershed as far back as 1850. However, no flood discharge records exist for floods that occurred along the North Nashua River prior to 1936. In that year, the United States Geological Survey (USGS) installed a discharge gaging station on the North Nashua River near the Leominster-Lancaster town line. Information on the five highest discharges recorded at this gaging station from its installation to present is given in Table 2.

Flood Records

Detailed information on the floods within the study area is limited to records of those floods that have occurred since the installation of the USGS gaging station on the North Nashua River. In general, information on past floods is based on data supplied by the USGS and on past newspaper accounts of floods.

Flood Descriptions

Past flooding has resulted in hazards to persons and property, channel and stream bank erosion, deposition of sediment and debris, and damage to roads and bridges. During floods, it is not uncommon for people to use boats as the only means of transportation, often-times to evacuate their homes. The nature of flooding is illustrated by the following information on two of the larger known floods to have hit the area.

March 1936 --

The March 1936 floods resulted from two separate storms of March 9-13 and 16-22. The first heavy rain fell on the snow cover which had a water content of about four inches. The amount of precipitation of the first storm was notable but not extraordinary. In general, it stands out only as a major contributing factor to the catastrophe that followed (See Figures 5 and 6). The weather became

unseasonably warm about March 9 and continued so during the remainder of the month. The water from the melting snows and the rainfall of five inches from the second storm flowed into streams already burdened with the waters of the first rain, producing high stages and devastating flooding.

September 1938 --

The flood of September 1938 resulted from the torrential rain of a tropical hurricane which passed up the Connecticut River Valley. The flood's magnitude was a result of the rainfall which began with light showers during the afternoon of September 17 and which continued with increasing intensity until late afternoon of September 21, when it ended. Total precipitation averaged 11.5 inches over an area of 10,000 square miles in the central storm area and produced river stages that inundated and damaged nearly everything on the river flood plains.



FIGURE 5 - March 1936 - Corner of Cushing Street in downtown business section, Station 475+35.



FIGURE 6 - March 1936 - View showing flood damaged Cushing Street Bridge, Station 475+35.



FIGURE 7 - Flood of September 1938. Looking downstream from Commercial Street Bridge towards Cushing Street Bridge, Station 479+50.



FIGURE 8 - Flood of September 1938. Looking downstream at Boston and Maine Railroad Bridge, Station 451+75.

FUTURE FLOODS

Although flood producing storms of the same magnitude as those that have occurred in the past could recur in the future, discussion of future floods in this report is limited to those that have been designated as the 100-year Flood and the Standard Project Flood. The 100-year Flood would be smaller and would occur more frequently than the Standard Project Flood, which would be a rare event, and yet could reasonably be expected to occur.

Flood Magnitudes and Their Frequencies

Flood frequencies developed for the study area can be found in Table 3. The 100-year Flood is defined as one that could be equalled or exceeded on the average of once in 100 years. This does not mean that a flood of this magnitude must occur once and only once every 100 years, but rather that in any given year, there is a one percent chance of the 100-year flood occurring.

The peak flow of each flood was developed from statistical analyses of streamflow precipitation records and runoff characteristics for the North Nashua River. Peak flows thus developed for the 50-, 100-year and Standard Project Floods at selected locations in the vicinity of the study area are shown in Table 4. The 5-, 10-, 20-, 50-, 100-year and Standard Project Flood peak flows were developed from similar analyses at the USGS Gaging Station in Leominster and are given in Table 3. Flood profiles for the North Nashua River were determined through backwater computations using these flood peak flows. Water surface profiles for the 100-year and Standard Project Floods are shown on Plates 5, 8, 11, 14 and 17.

Hazards of Large Floods

The amount and extent of damage caused by any flood depends on the topography of the area flooded, depth and duration of flooding, velocity of flow, rate of rise, and developments in the flood plain. The occurrence of 100-year or Standard Project Floods in the study area at the present time would result in extensive inundation of

residential, commercial and industrial areas. Also, flows from these floods would inundate many roads and bridges and interrupt traffic. Deep floodwater flowing at high velocity and carrying floating debris would create conditions hazardous to persons and vehicles attempting to cross flooded areas. In general, flood water three or more feet deep and flowing at a velocity of three or more feet per second, could easily sweep an adult person off his feet, thus creating definite danger of injury or drowning. Rapidly rising and swiftly flowing floodwater may trap persons in homes that are destroyed, or in vehicles that are ultimately submerged or floated. Water lines can be ruptured by deposits of debris and by the force of floodwaters, thus creating the possibility of contaminated domestic water supplies. Damage sanitary sewer lines and sewage treatment plants could result in the pollution of floodwaters creating health hazards. Isolation of areas by floodwater could create hazards in terms of medical, fire, or law enforcement emergencies.

Flooded Areas and Flood Damages

The areas in the towns of Leominster and Fitchburg that would be flooded by the Standard Project and 100-year Floods are shown on Plates 3, 4, 6, 7, 9, 10, 12, 13, 15 and 16. Plate 2 is an index map of the above exhibits. Plates 5, 8, 11, 14 and 17 show water surface profiles of the floods, and are arranged to correspond with the area maps. Depth of flow at any particular point can be estimated from these illustrations. The actual limits of these overflow areas may vary somewhat from those shown on the maps because the contour intervals and scale of maps do not permit the precise plotting of the flooded area boundaries.

Floodflows from the North Nashua River and its tributaries cover large portions within the study area. The areas that would be flooded include commercial, industrial, residential and agricultural sections and the associated streets, roads and private and public utilities in the towns of Fitchburg and Leominster. Considerable damage to these facilities would occur during a 100-year Flood. However, due to the wide extent, greater depths of flooding, higher velocity, flow, and longer duration of flooding during a Standard Project Flood, damages would be even more severe than during a 100-year Flood.

By using information in this report, government entities and individuals can make knowledgeable decisions relative to the use, development and management of areas subject to inundation.

Obstructions

During floods, debris collecting on bridges and culverts could decrease their carrying capacity and cause greater water depths (backwater effect) upstream of these structures. Since the occurrence and amount of debris are random and indeterminate factors, only the physical characteristics of the structures were considered in preparing profiles of the 100-year and Standard Project Floods. Similarly, the maps of flooded areas show the backwater effect of bridges, but do not reflect the increased water surface elevation that could be caused by debris collecting against the structures, or by the deposition of silt in the stream channel under structures. Several bridges would be obstructive to the 100-year and Standard Project Floods. Table 5 lists water surface elevations at bridges crossing the North Nashua River in the study area. The dams in the study area, listed in Table 6, have no flood control capacity. The backwater effect caused by the bridge crossings and dams is graphically illustrated by the profiles on Plates 5, 8, 11, 14, and 17.

Velocities of Flow

Velocities of floodwaters depend largely upon the size and shape of the cross section, the condition of the stream and the bed slope, all of which vary on different streams and at different locations on the same stream. During a 100-year Flood, velocities of main channel flow would be as much as twenty-one feet per second on the North Nashua River. Water flowing at this rate is capable of transporting large objects and severely eroding stream banks and fill around bridge abutments. It is expected that the velocity of main channel flow during the Standard Project Flood would be slightly higher than during a 100-year Flood. Water flowing at two feet per second or less would deposit debris and silt. Velocities greater than three feet per second combined with depths of three feet or greater are considered dangerous.

TABLE 5

BRIDGE DATA

North Nashua River
Fitchburg-Leominster, Massachusetts

<u>Identification</u>	<u>Station</u> ¹	<u>Low Steel</u> ²	<u>100 Yr. Flood</u> ²	<u>SPF Flood</u> ²
Mechanic Street	116+75	296.4	292.9	294.8
Route 2 Bridge	196+75	319.7	306.4	308.5
Main Street	220+75	325.6	323.8	327.5
Hamilton Street	237+75	326.9	328.5	332.2
Falulah Road	353+75	349.4	348.7	352.0
B & M RR	372+40	358.0	357.0	360.6
Bemis Road	388+85	373.3	370.8	377.0
B & M RR	420+00	406.5	405.9	408.8
Fifth Street	428+25	-----	409.0	412.4
Concrete Pipe	449+30	419.9	423.8	426.7
Private Road	449+50	420.7	423.9	428.3
Foot Bridge	449+75	426.2	424.4	428.5
B & M RR	451+75	424.8	429.0	430.4
Water Street	459+75	430.4	430.0	433.1
Laurel Street	471+75	447.8	434.6	437.6
B & M RR	474+00	432.8	438.1	441.0
Cushing Street	475+35	434.6	438.3	441.2
Commercial Street	479+50	442.1	443.7	445.6
Putnam Street	482+00	450.0	450.2	454.5

BRIDGE DATA
(Continued)

<u>Identification</u>	<u>Station</u> ¹	<u>Low Steel</u> ²	<u>100 Yr. Flood</u> ²	<u>SPF Flood</u> ²
B & M RR	483+50	442.9	453.5	460.0
B & M RR	493+25	449.3	455.4	461.4
Broad Street	505+00	464.5	460.8	466.9
Rollstone Road	505+50	464.5	461.6	468.0
Circle Street	510+25	465.5	462.3	473.3
River Street	518+75	467.2	471.0	476.0
Nockege Street	531+80	474.1	476.6	481.0
Sheldon Street	539+10	476.9	481.0	484.0
Building	539+50 to 540+00	477.1	484.0	488.0
River Street	553+00	485.4	490.6	491.9
B & M RR	554+00	491.2	493.9	498.4
Kimball Street	555+25	494.2	495.0	501.3
Daniels Street	562+40	494.7	499.0	505.0
B & M RR	566+00	495.9	504.8	507.5
Oak Hill Road	572+25	495.6	506.6	510.4
B & M RR	587+50	520.4	510.5	514.6
Fitchburg Paper Br.	596+30	508.0	511.2	515.7
Depot Street	615+65	518.6	523.5	531.0
Private Bridge	636+50	533.2	537.6	539.3
Crocker Burbank	658+20	554.4	559.7	561.7
B & M RR ³	691+75	604.6	597.0	599.0
Archway ³	709+50	621.2	619.0	625.0
Culvert ³	710+35	616.7	642.4	643.6
Fifth Mass. Tpke. ³	716+50	638.2	643.0	644.2

¹Distance from Leominster-Lancaster town line, measured along North Nashua River.

²Elevations are given in feet above mean sea level.

³Flag Brook.

TABLE 6

DAMS ON NORTH NASHUA RIVER
Fitchburg and Leominster, Massachusetts

<u>Identification</u>	<u>Station</u> ¹	<u>Crest Elevation</u> ²	<u>100-Year Elevation</u> ²	<u>SPF Flood</u> ²
Crocker Burbank ³	715+00	637.0	643.0	644.2
Breached Dam ³	672+00	573.3	574.2	575.9
Crocker Burbank	661+25	561.2	562.7	565.0
Crocker Burbank	638+75	540.2	546.5	547.7
Fitchburg Paper Co.	622+00	524.3	532.0	538.3
Fitchburg Paper Co.	598+25	511.3	522.2	525.0
Fitchburg Gas & Electric	440+75	409.6	418.3	419.8
Arden Mill	416+75	392.5	399.9	400.5
Duck Mill	401+55	378.0	383.7	384.6
Bemis Road	388+55	361.2	369.2	370.9
Wheelright Paper Co.	216+75	312.7	319.1	320.4
Breached Dam @ Gaging Station	25+95	272.4	287.0	289.6

¹ Distance from Leominster-Lancaster town line, measured along North Nashua River.

² Elevations are given in feet above mean sea level.

³ Flag Brook.

Rates of Rise and Duration of Flooding

The more critical floods, which can occur in any month of the year, develop from rainfall alone where the intensity of the rainfall, rather than the total volume, may determine the magnitude of the flood peaks. The quick development of floods is due to the many short, steep tributaries which empty into the main channel concurrently.

Photographs, Future Flood Heights

The levels that the 100-year and Standard Project Floods are expected to reach at various locations in the study area are indicated on the following photographs, Figures 9 through 12.

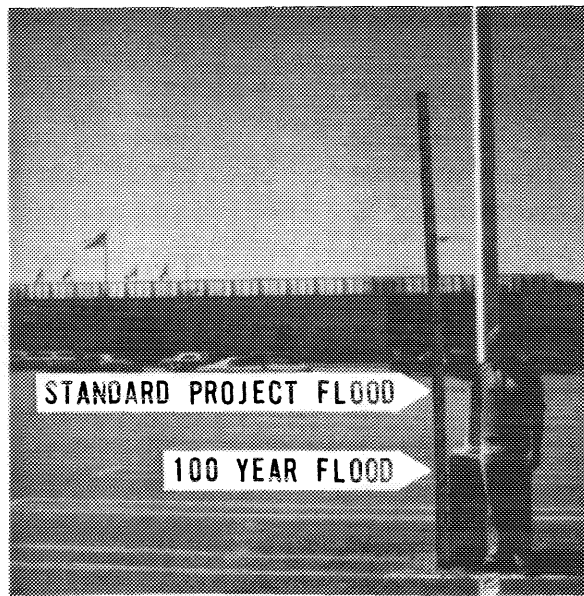


FIGURE 9 - Leominster - Future flood heights at Searstown Shopping Plaza, North Nashua River, Station 166+00.

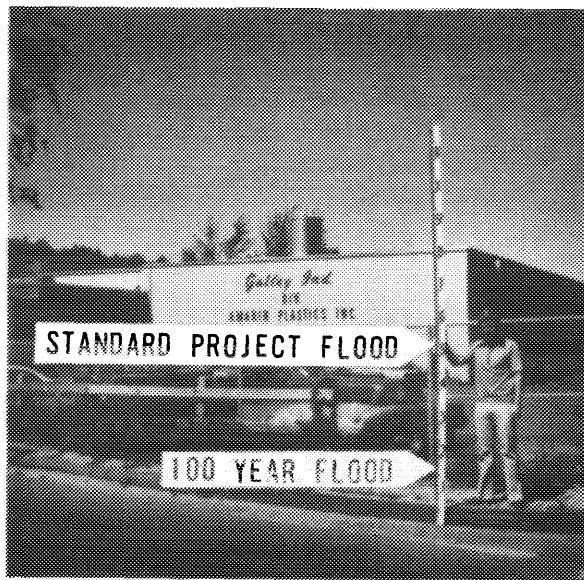


FIGURE 10 - Leominster - Future flood heights at Hamilton Street, North Nashua River, Station 237+75.



FIGURE 11 - Fitchburg - Future flood heights at Center Plaza, North Nashua River, Station 459+75.



FIGURE 12 - Fitchburg - Future flood heights at inoperative railroad bridge, North Nashua River, Station 566+00.

GUIDELINES FOR FLOOD PLAIN MANAGEMENT

Man has been building on and occupying the flood plains of rivers and streams since the arrival of pioneer settlers. The streams first provided transportation and water supply and later their gentle valley grades encouraged the construction of highways and railroads. Today uncontrolled growth of cities often results in unwise encroachment on the flood plains of local streams.

Through bitter experience, man has learned that floods periodically inundate portions of the flood plain, damaging property and often causing loss of life. This experience has led to a relatively new approach for reducing flood damages. Called "flood plain management," this approach consists of applying controls over the use of land lying adjacent to streams. Planned development and management of flood hazard areas can be accomplished by a variety of means.

Interpretation of Data

Flooded area maps and profiles are provided in this report to define the limits of flooding that would occur during a 100-year flood and the Standard Project Flood. The actual limits of these overflow areas on the ground will vary from those shown because the scales of the available maps do not permit precise plotting of the flooded area boundaries. Important land use decisions in specific areas should be verified by field surveys. Changes in the land use, drainage patterns, and structural occupancy of the flood plain may result in higher flood elevations than those shown.

Hypothetical examples of the map and profile, shown on Figure 13, depict the areal limits and elevations of the respective floods at imaginary locations.

The lateral limits of flooding from the 100-year flood are shown by the light shaded area, while the darker area indicates the additional land that would be inundated by the Standard Project Flood. The line and numeral in the shaded area represent the elevation of the 100-year flood at that particular location. The flood profile shows the relative depth of floodwaters along the centerline of the stream.

HYPOTHETICAL FLOOD PLAIN INFORMATION

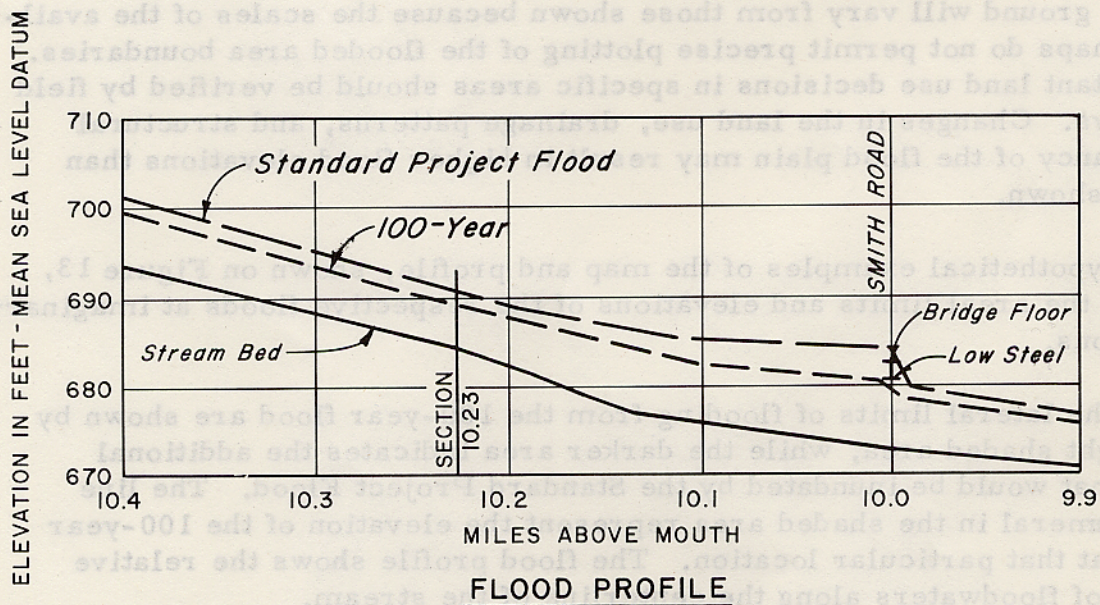
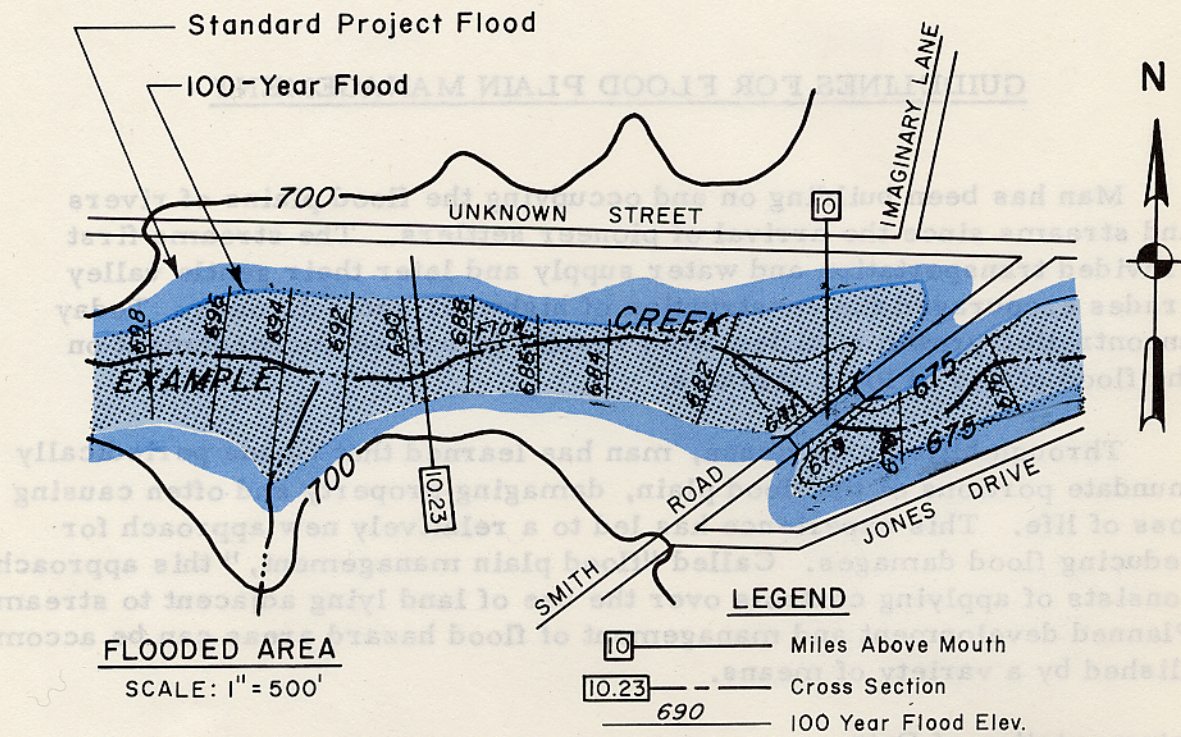


FIGURE 13

By using information as illustrated, together with other data such as frequency of occurrence, velocity of flow, and duration of flooding, government entities and individuals can make knowledgeable decisions relative to the use, development, and management of areas subject to inundation.

Flood Plain Management Tools

The main purpose of this report is to provide guidance for intelligent land use in the river basin. This includes recognition of the existing flood hazards associated with streams in the area. Citizens of this and other watersheds have learned from experience that the development of flood hazard areas should take place only with full knowledge of the risk and social cost involved. The following remarks concerning possible uses for the data presented herein are not intended to be all inclusive. They are meant to provide a cursory guide for utilizing the information on the flooding conditions in the river basin to the best advantage. The measures available for reducing flood losses can be subdivided into two general classifications, Regulatory and Nonregulatory.

Regulatory Measures

Regulation of flood plain land use can substantially contribute to the reduction of future flood damages and risk, while contributing to other important objectives such as regional development and improvement or preservation of environmental attributes. Of course, use here of the word "regulation" is not meant to imply nonuse of flood plain lands or any type of inequitable treatment of present or future land owners.

Federal agencies do not have the authority to regulate flood plain development. This authority was assigned to the states (and their political subdivisions) in the tenth amendment to the U.S. Constitution and has never been delegated to the Federal Government. Consequently, it is local government bodies utilizing available state legislation that have to assume the day to day responsibility for guiding development in flood prone areas.

The principal regulatory devices used at local governmental levels include zoning ordinances, subdivision regulations, and building and health codes. The following is a discussion of these four types of regulations.

a. Flood plain zoning ordinances are usually "super-imposed" on existing zoning ordinances. They may be used to implement broader land use plans and to reduce future flood losses by stipulating the type of building development permitted in flood prone areas. They can also be used to limit flood plain development by establishing flood plain encroachment limits. These regulations should exclude obstructions from flooding areas which adversely affect flood heights and allocate the flood plain to uses consistent with the degree of the flood threat. Floodways can be established along modified (enlarged, straightened) or natural stream channels. See the GLOSSARY OF TERMS for a definition of the terms "floodway" and "encroachment limits". The floodway and encroachment limit concepts are also illustrated on Figure 14.

b. Subdivision control ordinances may also be effective tools for flood plain building control. Subdivision control relates to the way in which land is divided and made ready for building development. For example, a city may control the subdivision of land within its jurisdiction by requiring that a large percentage of the minimum lot area of a subdivision be a designated height above an adopted floodwater elevation as a requisite for plat approval. Unlike zoning ordinances, which extend only to a city's limits, cities have some control over subdivision development in areas within their extraterritorial jurisdiction.

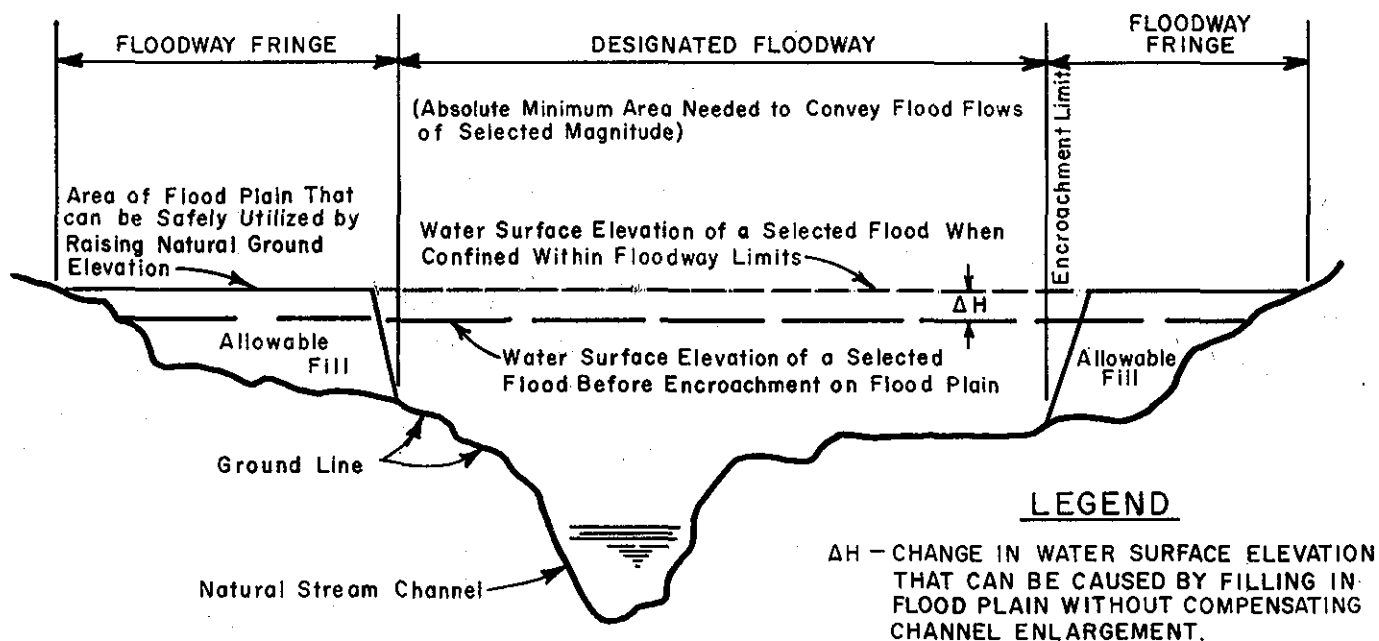
c. Building codes set forth standards of construction for the purposes of protecting health, safety, and general welfare of the public. Building codes may be written to set minimum standards for water (flood) proofing of structures, for establishing minimum first floor elevations consistent with potential flood occurrences, and requirements for material strength and proper anchorage.

d. Health codes can serve as a control over the use of flood plains for waste disposal and the construction of water and sewage treatment facilities that may create health problems during floods.

Nonregulatory Measures

Other methods that can be used to reduce flood damage losses include:

a. Structural measures can be used to reduce flood heights (channel modifications, dams) or provide a barrier between floodwaters and development (levees, dikes).



FLOODWAY FRINGE

Suggested Uses

Uses permitted in the floodway area.
Residential, Commercial, Industrial,
Public & other development with
floodwater entry points at or above
design elevation for encroachment.

Uses Not Appropriate

Hospitals & Nursing Homes
Boarding Schools & Orphanages
Sanitariums
Detention Facilities
Refuge Centers
Permanent Storage of Materials
or Equipment (Emergency Equipment)

FLOODWAY AREA

Suggested Uses

Farms, Truck Gardens & Nurseries
Livestock & Other Agricultural Uses.
Non-obstructive Structures
Parking Lots, Playgrounds & Parks
Golf Course & Open Recreation
Preserves & Reservations.

Uses Not Appropriate

Land Fills & Obstructive Structures
Floatable Storage
Disposal of Garbage
Rubbish, Trash or Offal
All uses precluded from floodway
fringe area.

**FLOOD PLAIN CROSS SECTION
SHOWING FLOODWAY & ENCROACHMENT LIMIT CONCEPTS**

b. Fee purchase of lands for open space uses. Many grant and loan programs are available to local governments through the Department of Housing and Urban Development and other Federal agencies for preserving flood plain lands as green belts, development of these areas for parks, nature trails, etc.

c. Acquisition of flooding easements. Purchase of less than fee interest in flood prone land is another approach to controlling development.

d. Flood proofing by elevating structures, water proofing, or filling of low areas for building sites. Some buildings can be raised in place up to a reasonable limit to prevent flood damages. Other structures can be made to withstand flood velocities and depths through the use of bulkheads, watertight openings, flotation anchors, plumbing cutoff valves, and structural reinforcements. Structures can be built in flood plain fringe areas at elevations above a selected flood magnitude. However, this should be done only in connection with an established floodway width or encroachment limits to eliminate obstructions that would raise upstream flood stages.

e. Flood insurance can now be made available through the Department of Housing and Urban Development to communities that adopt appropriate flood plain regulations. Flood insurance does not reduce flooding or flooding caused damages, but reduces the risk of large economic losses by individual flood victims.

f. Development policies in regard to extending public services. "Flood conscious" governmental policies that limit or discourage the extension of public roads, utilities and other services into flood prone areas can play an important role in encouraging prudent flood plain use. Private developments usually depend on the extension of public services. By avoiding the extension of such services into flood hazard areas, local government and private utility companies can encourage the occupancy of safer, and in the long run, cheaper flood free areas.

Very little building is carried on without outside financing. Therefore, lending institutions, both Federal and private, are in a position to exercise control over flood plain development by denying mortgage guarantees or funds to subdivision or individual builders for projects that will eventually become "flood problems."

"IT WASN'T RAINING WHEN NOAH BUILT THE ARK!"

GLOSSARY OF TERMS

BACKWATER - The resulting high water surface in a given stream due to a downstream obstruction or high stages in an intersecting stream.

ENCROACHMENT LIMITS - A limit of obstruction to flood flows. Encroachment limits are normally established on the ground through the use of markers. These encroachment "lines" are roughly parallel to a stream on each bank. Encroachment lines are established by assuming that the area landward (outside) of the lines will be ultimately developed in such a way that it will not be available to convey flood flows.

FLOOD - An overflow of water onto lands not normally covered by water and that are used or usable by man. Floods have two essential characteristics; the inundation of land is temporary; and the land is adjacent to and inundated by overflow from a river or stream or an ocean, lake, or other body of standing water.

Normally, a "flood" is considered as any temporary rise in streamflow or stage (but not the ponding of surface water) that results in significant adverse effects in the vicinity. Adverse effects may include damages from overflow of land areas, temporary backwater effects in sewers and local drainage channels, creation of unsanitary conditions or other unfavorable situations by deposition of materials in stream channels during flood recessions, rise of ground water coincident with increased streamflow, and other problems.

FLOOD CREST - The maximum stage or elevation reached by the waters of a flood at a given location.

FLOOD HYDROGRAPH - A graph showing the stage in feet against time at a given point and the rate of rise and duration above flood stage.

FLOOD PLAIN - The areas adjoining a river, stream, watercourse, ocean, lake, or other body of standing water, which has been or may be covered by floodwater.

FLOOD PROFILE - A graph showing the relationship of water surface elevation to location, the latter generally expressed as distance above mouth for a stream of water flowing in an open channel. It is generally drawn to show surface elevation for the crest of a specific flood, but may be prepared for conditions at a given time or stage.

FLOOD STAGE - The stage or elevation at which overflow of the natural banks of a stream or body of water begins in the reach or area in which the elevation is measured.

FLOODWAY - a. Natural Floodway is the channel of a watercourse and those portions of the adjoining flood plain which are reasonably required to carry and discharge the floodwaters of a selected probability-of-occurrence flood.

b. Designated Floodway is the channel of a watercourse and that portion of the adjoining flood plain required to provide for the passage of a selected flood with an insignificant increase in flood stage above that of natural conditions. Normally, the 100-year flood (one that has a 1% chance of occurrence in any given year) should be considered as the selected flood. An "insignificant increase" is normally considered to be no greater than 1 foot, unless a smaller increase is established by State or local regulation.

HURRICANE - An intense cyclonic windstorm of tropical origin in which winds tend to spiral inward in a counter-clockwise direction toward a core of low pressure with maximum surface wind velocities that equal or exceed 75 miles per hour (65 knots) for several minutes or longer at some points. Tropical storm is the term applied if maximum winds are less than 75 miles per hour.

LEFT BANK - The bank on the left side of a river, stream or watercourse looking downstream.

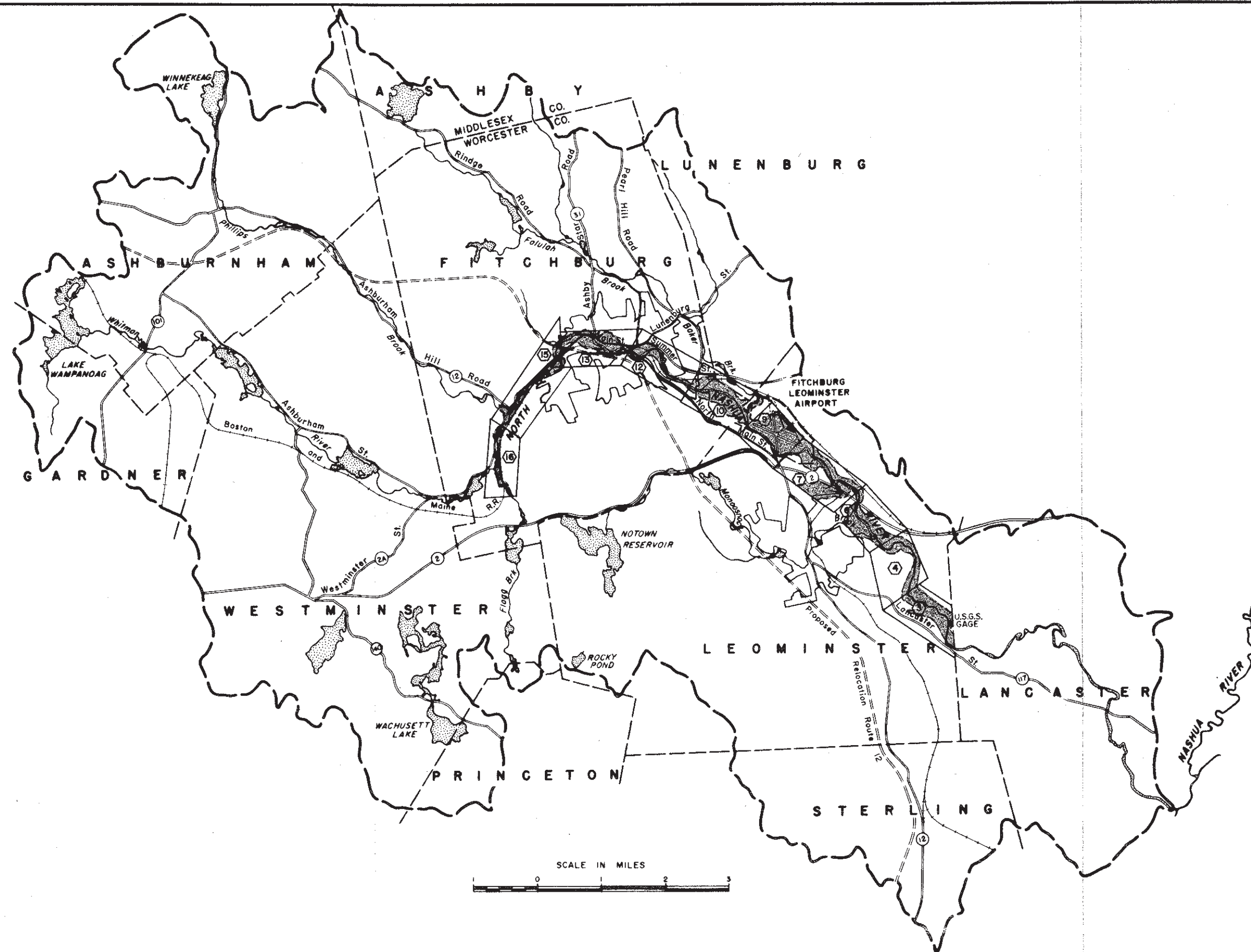
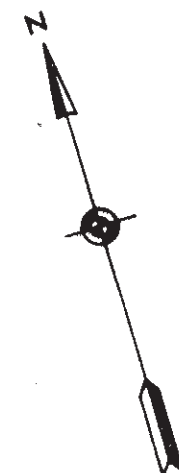
ONE HUNDRED YEAR FLOOD - A flood having an average frequency of occurrence in the order of once every 100 years, although the flood may occur in any year. It is based on statistical analyses of streamflow records available for the watershed. The 100-year flood has also been known as the "Intermediate Regional Flood."

PROBABLE MAXIMUM FLOOD - A hypothetical flood representing the most severe flood with respect to volume, concentration of runoff, and peak discharge that may be expected from a combination of the most severe meteorological and hydrological conditions in the region.

RIGHT BANK - The bank on the right side of a river, stream, or watercourse looking downstream.

STANDARD PROJECT FLOOD - The flood that may be expected from the most severe combination of meteorological and hydrological conditions that are considered reasonably characteristic of the geographical area in which the drainage basin is located, excluding extremely rare combinations. Peak discharges for these floods are generally about 40% to 60% of the Probable Maximum Floods for the same basins. Such floods, as used by the Corps of Engineers, are intended as practicable expressions of the degree of protection that should be sought in the design of flood control works, the failure of which might be disastrous.

UNDERCLEARANCE ELEVATION - The elevation at the top of the opening of a culvert or other structure through which water may flow along a watercourse. This is referred to as "low steel" in some regions.



LEGEND

- ② STATE HIGHWAY
- TOWN LINE
- ⑤ PLATE NUMBER
- STANDARD PROJECT FLOOD

FLOOD PLAIN INFORMATION
NORTH NASHUA RIVER
FITCHBURG AND LEOMINSTER
MASSACHUSETTS
INDEX MAP - FLOODED AREAS
APRIL 1977
DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS.



LEGEND

OVERFLOW LIMITS

CHANNEL 100 YEAR FLOOD STANDARD PROJECT FLOOD

100 YEAR FLOOD ELEVATION

50+00 STA IN FEET ABOVE LEOMINSTER-LANCASTER LINE

300 GROUND ELEVATION IN FEET (U.S.C.&G.S.) SEA LEVEL DATUM

TOWN LINES

NOTES:

1. MAP BASED ON MASSACHUSETTS PHOTOGRAMMETRICS FILE NO. 241 AND NO. 271 WESTMINSTER TO FITCHBURG. MINOR ADDITIONS AND ADJUSTMENTS MADE BY CORPS OF ENGINEERS.
2. LIMITS OF OVERFLOW SHOWN MAY VARY FROM ACTUAL LOCATION ON GROUND AS EXPLAINED IN THE REPORT.
3. AREAS OUTSIDE THE FLOOD PLAIN MAY BE SUBJECT TO FLOODING FROM LOCAL RUNOFF.
4. MINIMUM CONTOUR INTERVAL IS 5 FT.

SCALE IN FEET

0 200 400 800

FLOOD PLAIN INFORMATION

FITCHBURG AND LEOMINSTER

MASSACHUSETTS

NORTH NASHUA RIVER

FLOODED AREAS

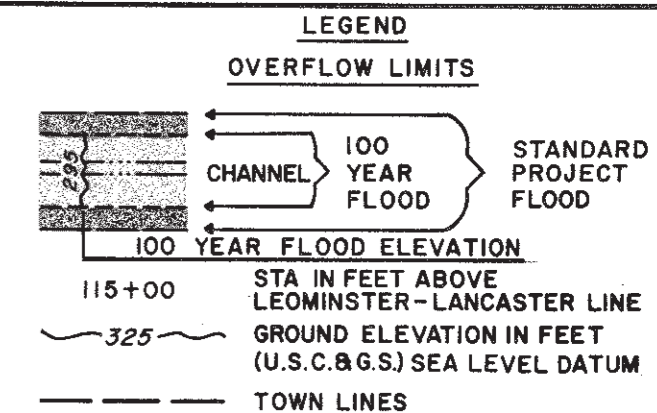
STA 0+00 TO 80+00

APRIL 1977

DEPARTMENT OF THE ARMY

NEW ENGLAND DIVISION, CORPS OF ENGINEERS

WALTHAM, MASS.



NOTES:

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FLOOD PLAIN INFORMATION

FITCHBURG AND LEOMINSTER

MASSACHUSETTS

NORTH NASHUA RIVER

FLOODED AREAS

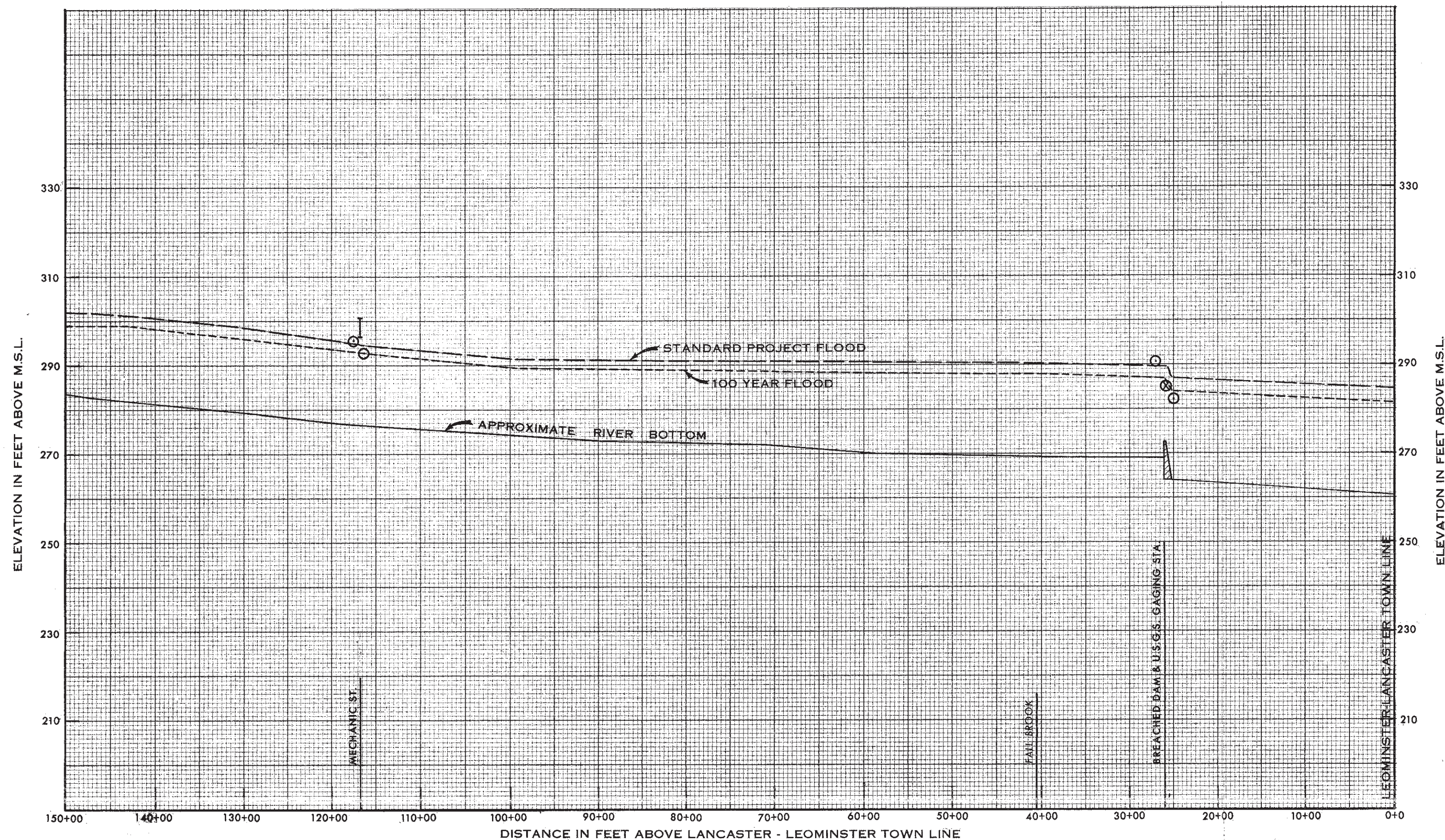
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APRIL 1977





DEPARTMENT OF THE ARMY

NEW ENGLAND DIVISION, CORPS OF ENGINEERS

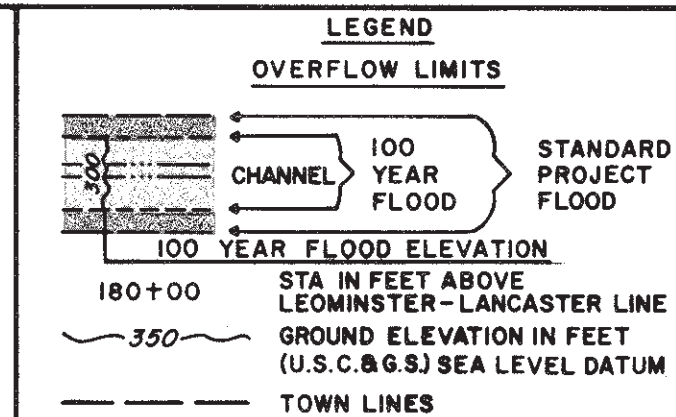
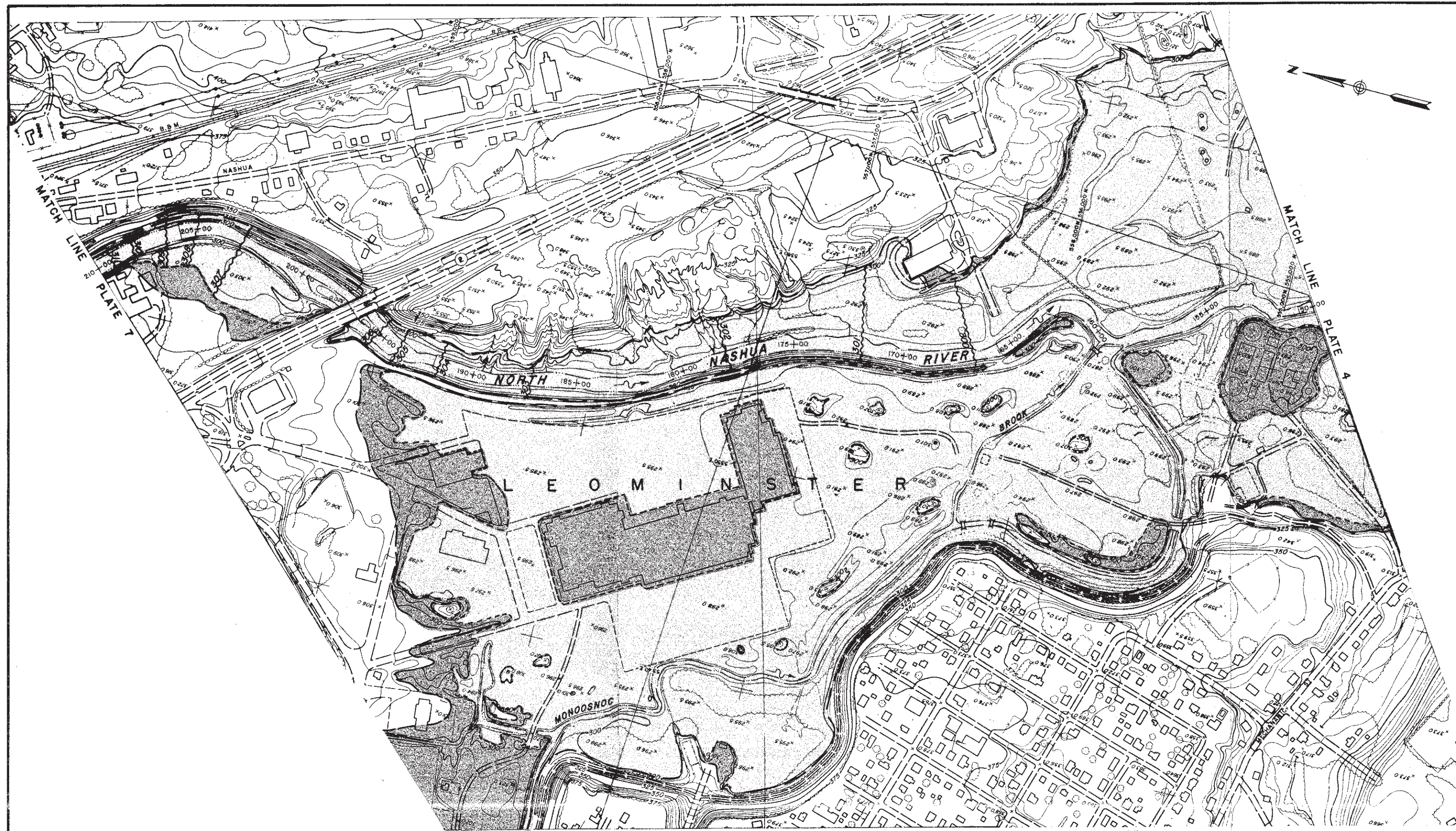
WALTHAM, MASS.



LEGEND

-  DAM
-  BRIDGE
-  MARCH 1936 HIGH WATER
-  SEPTEMBER 1938 HIGH WATER

FLOOD PLAIN INFORMATION
 FITCHBURG AND LEOMINSTER
 MASSACHUSETTS
 NORTH NASHUA RIVER
 PROFILE
 STA 0+00 TO 150+00
 APRIL 1977
 DEPARTMENT OF THE ARMY
 NEW ENGLAND DIVISION, CORPS OF ENGINEERS
 WALTHAM, MASS.



- NOTES:**
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FLOOD PLAIN INFORMATION

FITCHBURG AND LEOMINSTER

MASSACHUSETTS

NORTH NASHUA RIVER

FLOODED AREAS

STA 150+00 TO 210+00

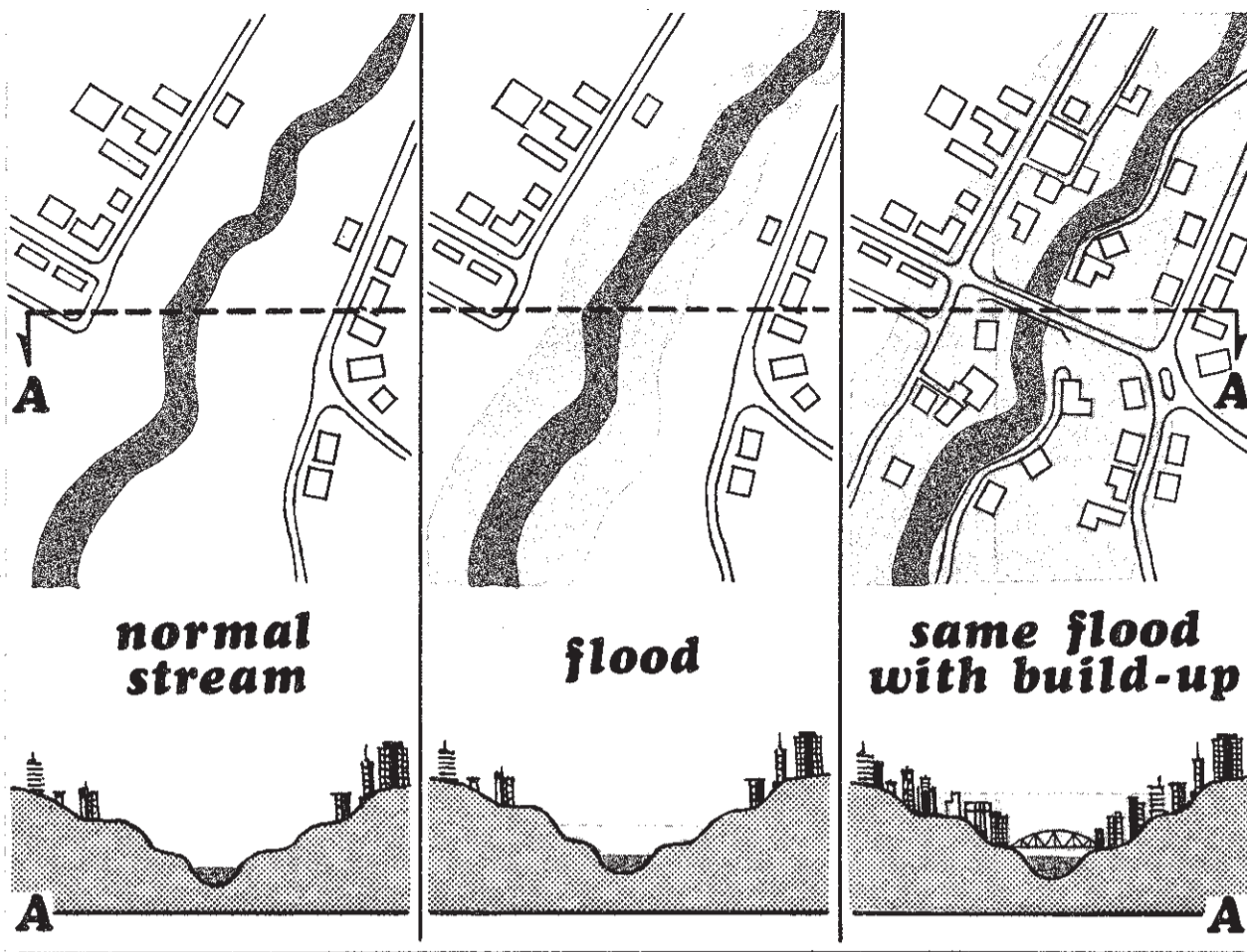
APRIL 1977

DEPARTMENT OF THE ARMY

NEW ENGLAND DIVISION, CORPS OF ENGINEERS

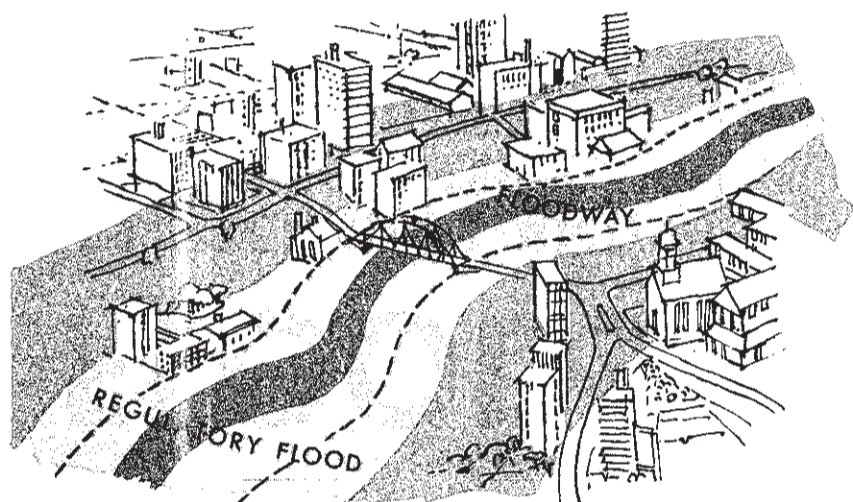
WALTHAM, MASS.

**BUILDING
in the
FLOOD PLAIN
can make
FLOODS
WIDER
and
DEEPER**



this
ENCROACHMENT
can change
a
Small Flood
into a
**MAJOR
FLOOD**

TOOLS of FLOOD PLAIN MANAGEMENT for the reduction of Flood Damage and Human Suffering



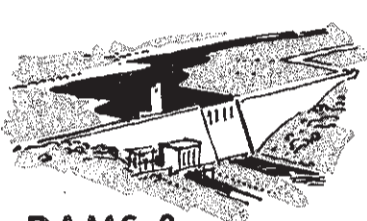
MEASURES TO REDUCE VULNERABILITY TO FLOODS provide for a future with more freedom from flood damage, often at minor cost and with little adverse effect on the environment

REGULATIONS

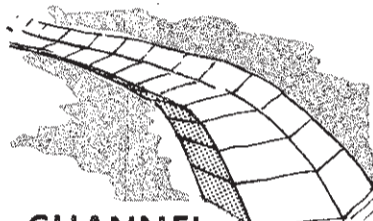
- (ZONING, BUILDING CODES, SUBDIVISION)
- FLOOD PROOFING • RELOCATIONS •
- URBAN RENEWAL •

MEASURES TO MODIFY FLOODS

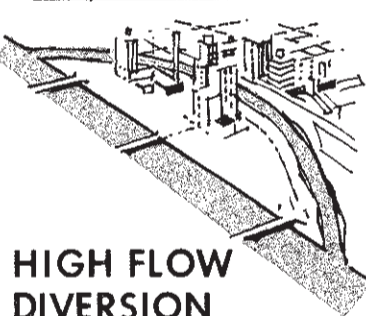
are often required to alleviate existing problems and sometimes to forestall future problems . . .



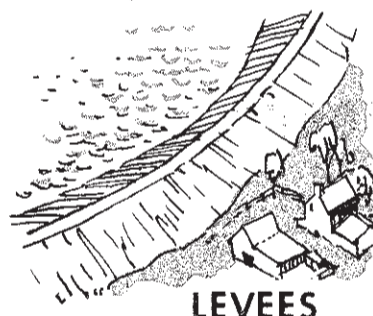
DAMS & RESERVOIRS



CHANNEL ENLARGEMENT



HIGH FLOW DIVERSION



LEVEES

OTHER

MEASURES

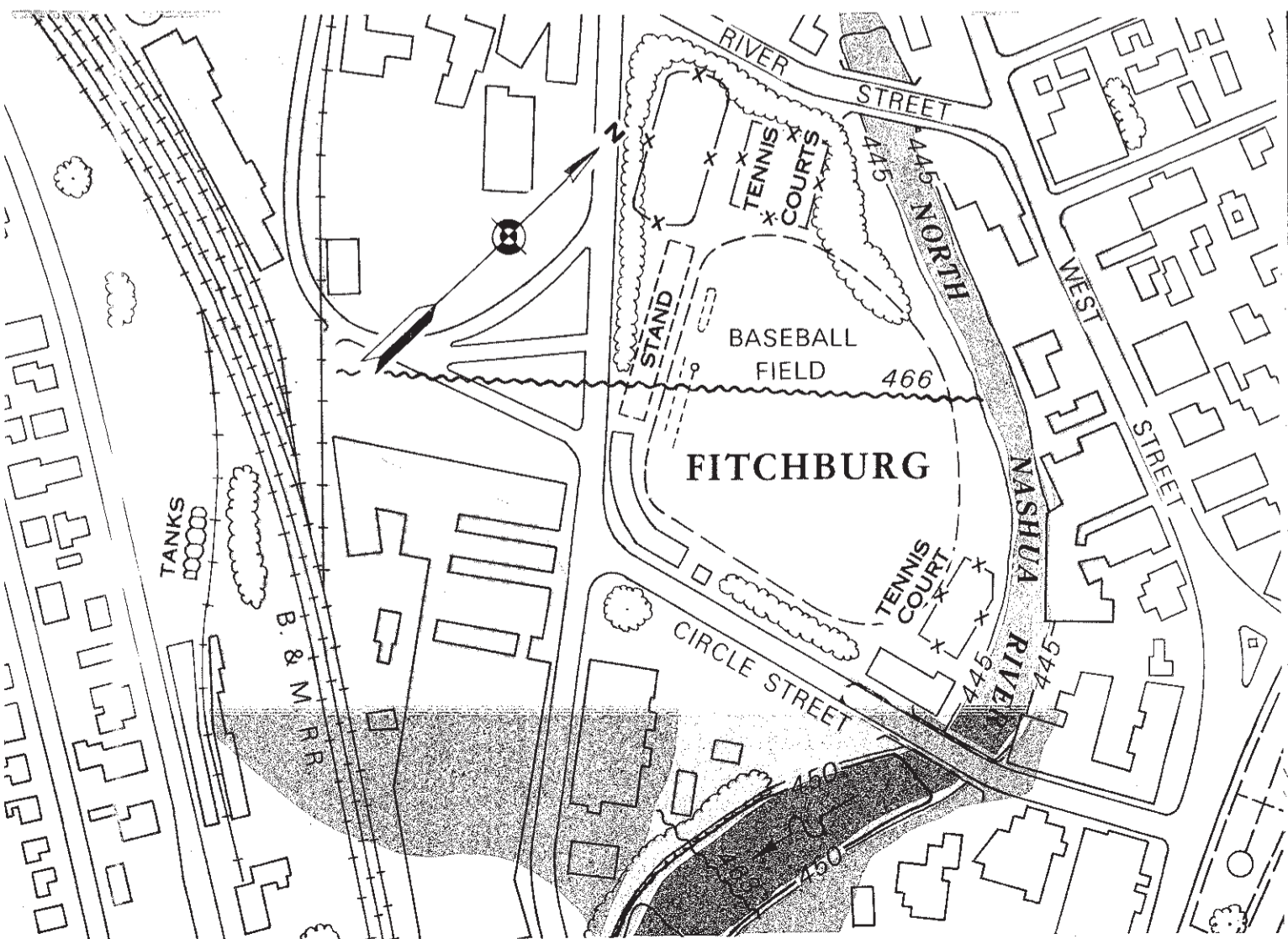
aid the Flood Plain occupant in coping with floods . . .

EDUCATION

TAX ADJUSTMENTS

FLOOD INSURANCE

WARNING & EMERGENCY PLANS



FLOOD PATTERNS FOR FITCHBURG AND LEOMINSTER, MASSACHUSETTS

LEGEND

approximate limits of overflow

NORMAL STREAM

100 YEAR FLOOD

STANDARD PROJECT FLOOD

466 100 YEAR FLOOD ELEVATION LINE

PROFILES in the Flood Plain Information Report show elevations of these floods for the entire study area

SPF	Estimated Discharges (cfs)	Date
24,000		
18,000		100 Year
16,300		March 18, 1936
10,300		September 21, 1938
8,870		October 15, 1955
8,100		June 25, 1944
5,800		September 11, 1954

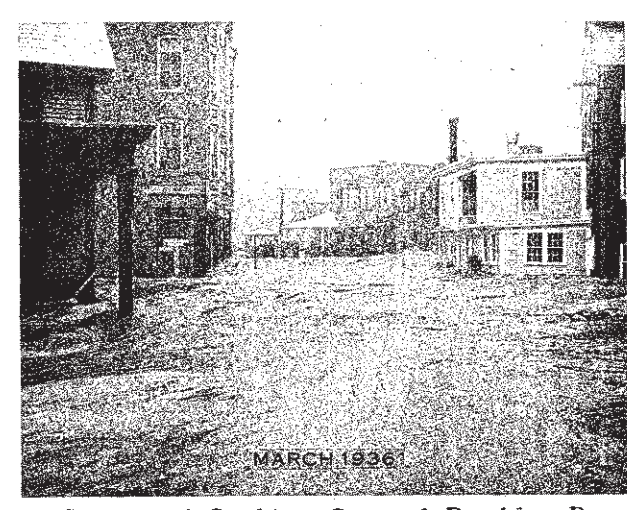
MAXIMUM FLOOD DISCHARGES
NORTH NASHUA RIVER
Leominster Gaging Station

This folder is an announcement of and supplement to the "Flood Plain Information (FPI) Report, North Nashua River, Fitchburg and Leominster, Massachusetts". The report has been prepared because a knowledge of flood potential and flood hazards is important in land use planning and for management decisions concerning flood plain utilization.

FLOODS IN FITCHBURG AND LEOMINSTER MASSACHUSETTS



FLOODS NORTH NASHUA RIVER FITCHBURG & LEOMINSTER MASSACHUSETTS



Corner of Cushing St. and Boulder Dr.
in Downtown Business Section

Inside are sketches illustrating the horizontal and vertical relationships of flooded areas and a flood area map from the report showing the extent of both a large flood, termed a 100 year flood, and a very large flood, termed a Standard Project Flood.

Included in this folder are photographs showing possible future flood heights at selected locations.

Although the above communities have suffered extensive damage from major floods in the past, studies indicate that damaging floods can still occur in the future. The FPI report places emphasis upon future floods in the area.

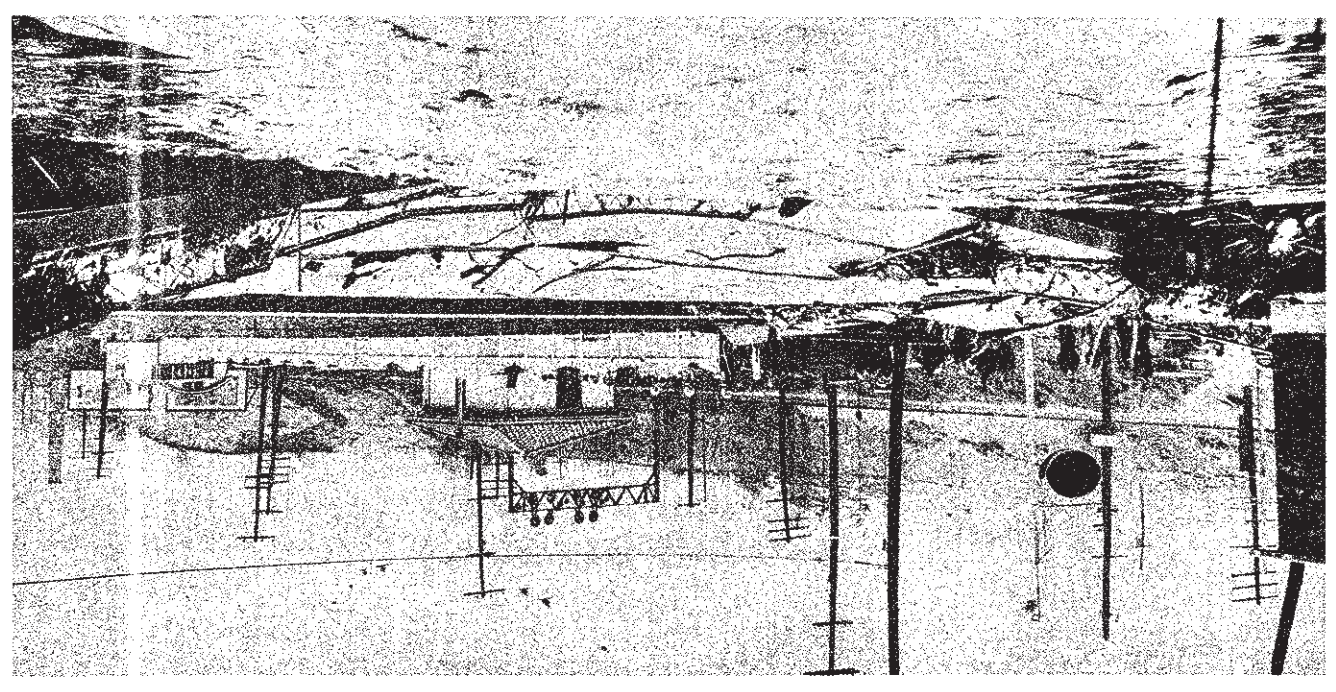
Cities and towns along the above stream are not the only communities with flooding problems. Flood Plain Information has already been provided for many of several thousand flood plagued communities.

More than 1190 of those having FPI Reports have adopted or strengthened regulations, while 1200 others have them under study. An additional 2031 communities are using the FPI Reports to establish interim land use control.



Future Flood Heights
Center Plaza - Fitchburg

This folder has been prepared by the U.S. Army Corps of Engineers from data in the report "Flood Plain Information, North Nashua River, Fitchburg and Leominster, Massachusetts". Copies of the report and this folder are available upon request from the above community.



Oak Hill Road Bridge Washed Out by North Nashua River, March 1936 - Fitchburg



Oak Hill Road Bridge, Flood of September 1938 - Fitchburg

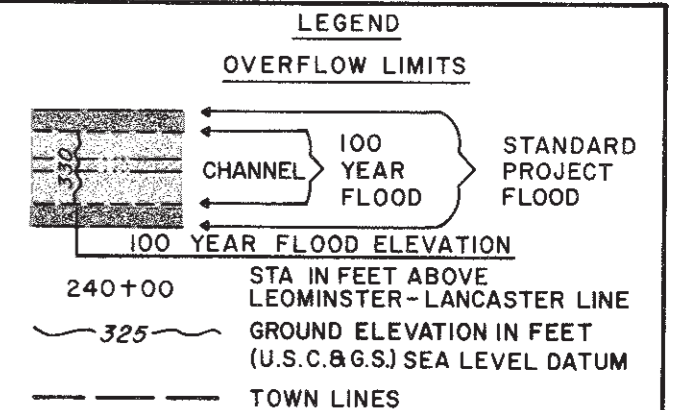
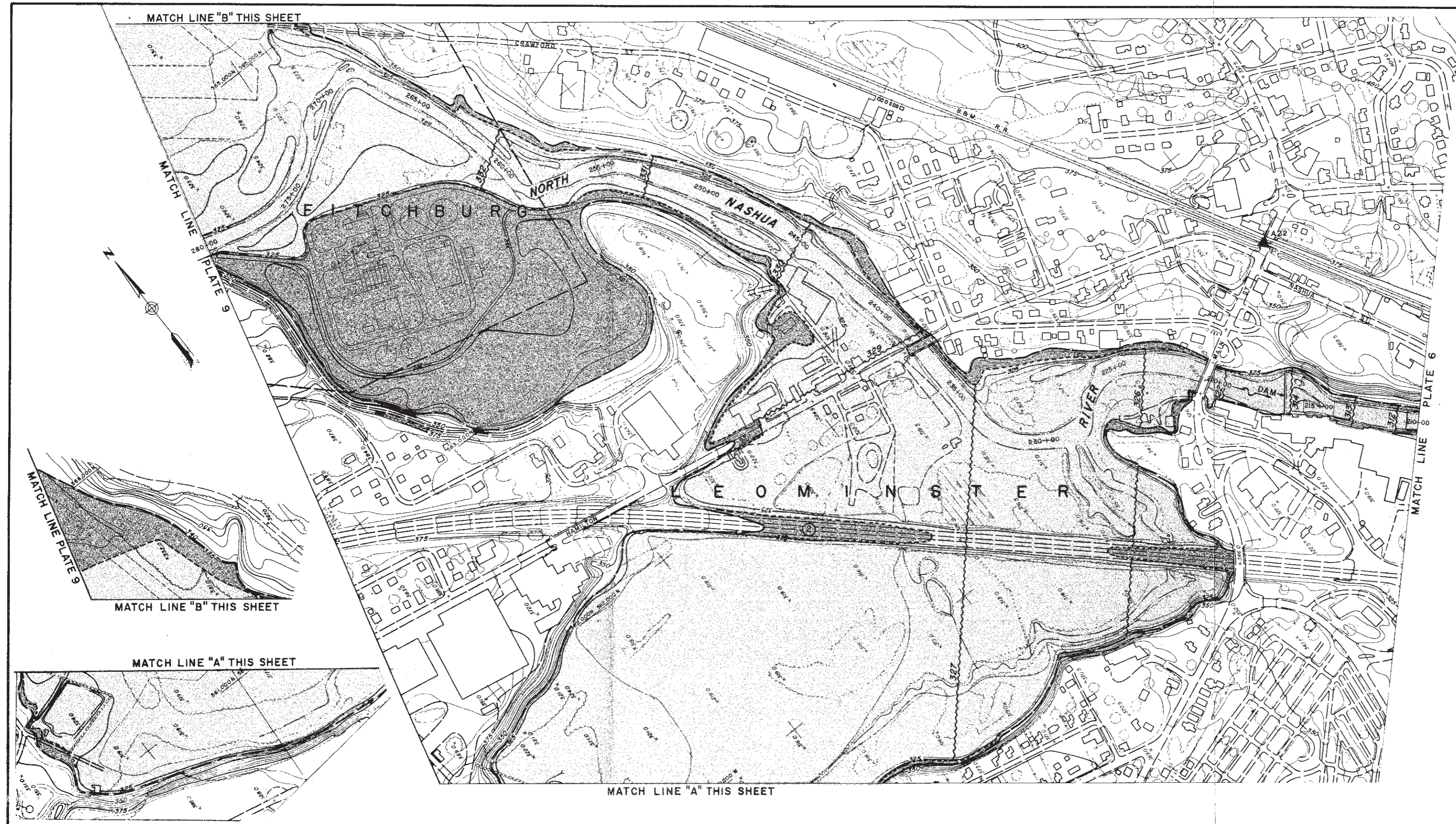
ACTION is needed

The flood plains along the North Nashua River in the cities of Fitchburg and Leominster have been encroached upon in the past by industrial, residential and commercial buildings. The devastating effects of flooding will continue to increase unless action is taken.

Effective regulatory measures such as zoning ordinances and building codes can be designed to prevent increased flood damages. Flood proofing can reduce potential damages to properties already subject to flooding, and additional works to modify flooding can also be a part of the long-run solution.



Future Flood Heights Sears Town Shopping Center - Leominster



- NOTES:**
1. MAP BASED ON MASSACHUSETTS PHOTOGRAMMETRICS FILE NO. 241 AND NO. 271 WESTMINSTER TO FITCHBURG. MINOR ADDITIONS AND ADJUSTMENTS MADE BY CORPS OF ENGINEERS.
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FLOOD PLAIN INFORMATION

FITCHBURG AND LEOMINSTER

MASSACHUSETTS

NORTH NASHUA RIVER

FLOODED AREAS

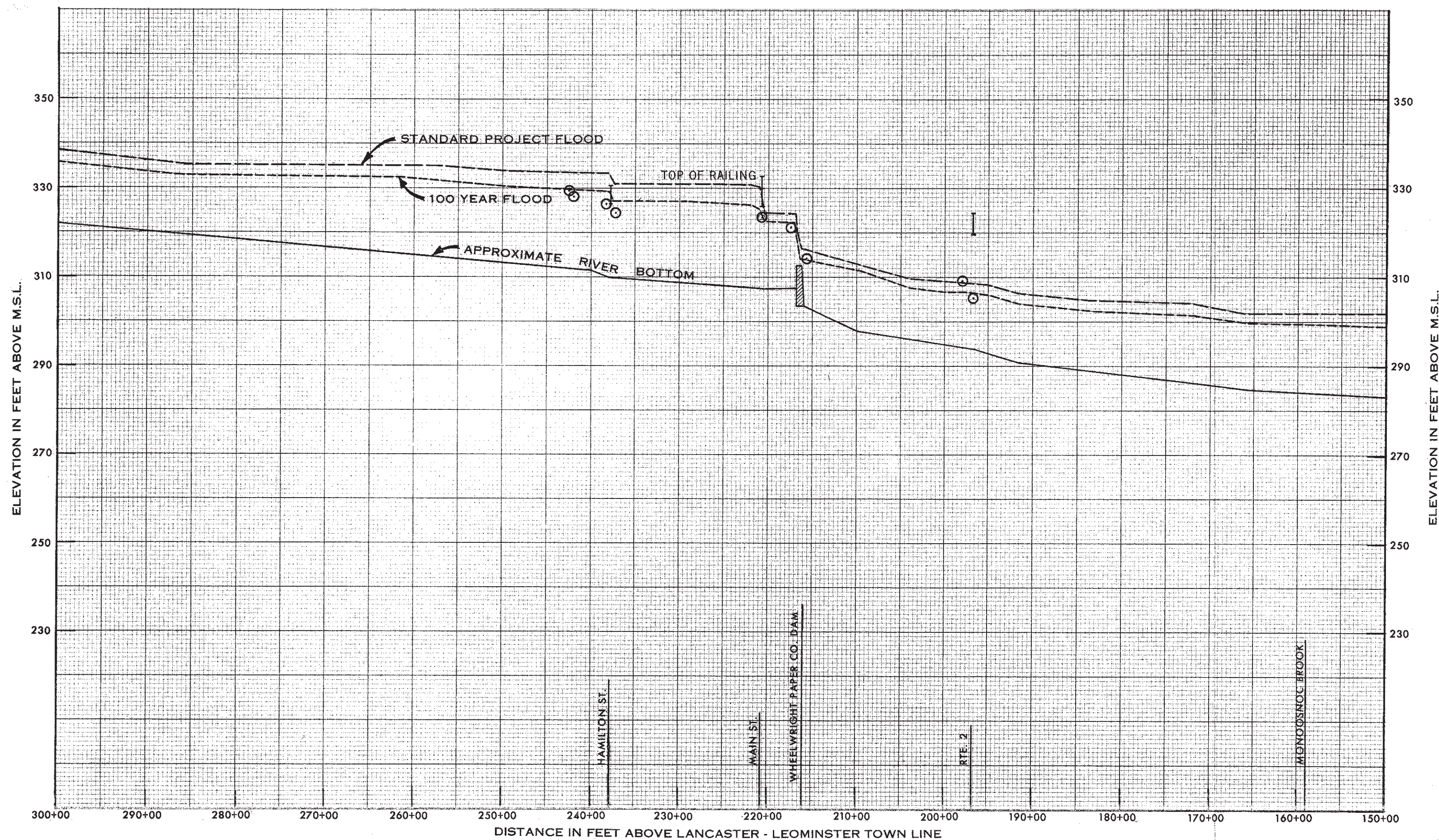
STA 210+00 TO 280+00

APRIL 1977




DEPARTMENT OF THE ARMY

NEW ENGLAND DIVISION, CORPS OF ENGINEERS

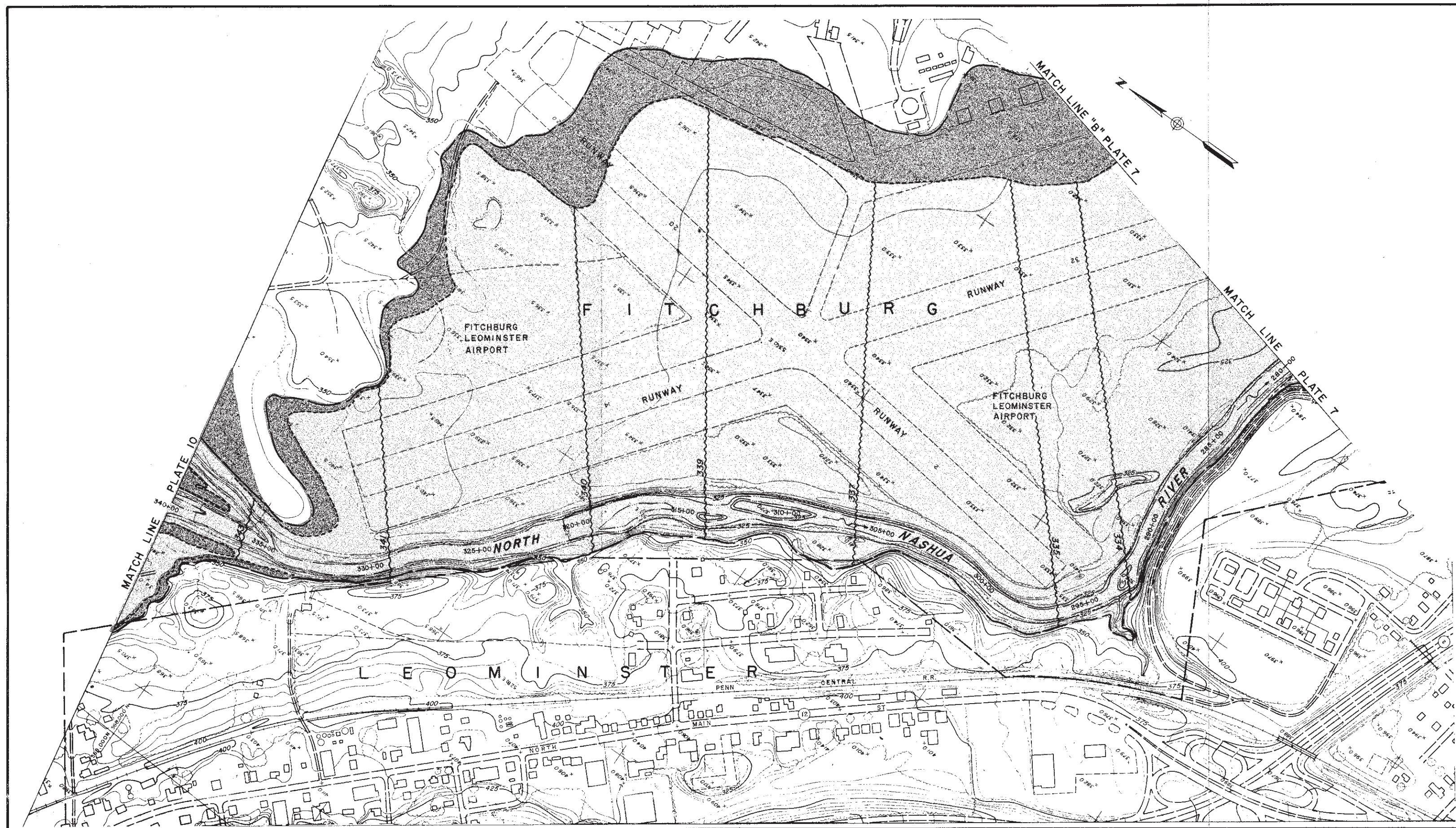
WALTHAM, MASS.



LEGEND

-  DAM
-  BRIDGE
-  MARCH 1936 HIGH WATER

FLOOD PLAIN INFORMATION
 FITCHBURG AND LEOMINSTER
 MASSACHUSETTS
 NORTH NASHUA RIVER
 PROFILE
 STA 150+00 TO 300+00
 APRIL 1977
 DEPARTMENT OF THE ARMY
 NEW ENGLAND DIVISION, CORPS OF ENGINEERS
 WALTHAM, MASS.



LEGEND

OVERFLOW LIMITS

100 YEAR FLOOD

STANDARD PROJECT FLOOD

100 YEAR FLOOD ELEVATION

310+00 STA IN FEET ABOVE LEOMINSTER-LANCASTER LINE

325 GROUND ELEVATION IN FEET (U.S.C.&G.S.) SEA LEVEL DATUM

TOWN LINES

- NOTES:**
1. MAP BASED ON MASSACHUSETTS PHOTOGRAMMETRICS FILE NO. 241 AND NO. 271 WESTMINSTER TO FITCHBURG. MINOR ADDITIONS AND ADJUSTMENTS MADE BY CORPS OF ENGINEERS.
 2. LIMITS OF OVERFLOW SHOWN MAY VARY FROM ACTUAL LOCATION ON GROUND AS EXPLAINED IN THE REPORT.
 3. AREAS OUTSIDE THE FLOOD PLAIN MAY BE SUBJECT TO FLOODING FROM LOCAL RUNOFF.
 4. MINIMUM CONTOUR INTERVAL IS 5 FT.



FLOOD PLAIN INFORMATION

FITCHBURG AND LEOMINSTER

MASSACHUSETTS

NORTH NASHUA RIVER

FLOODED AREAS

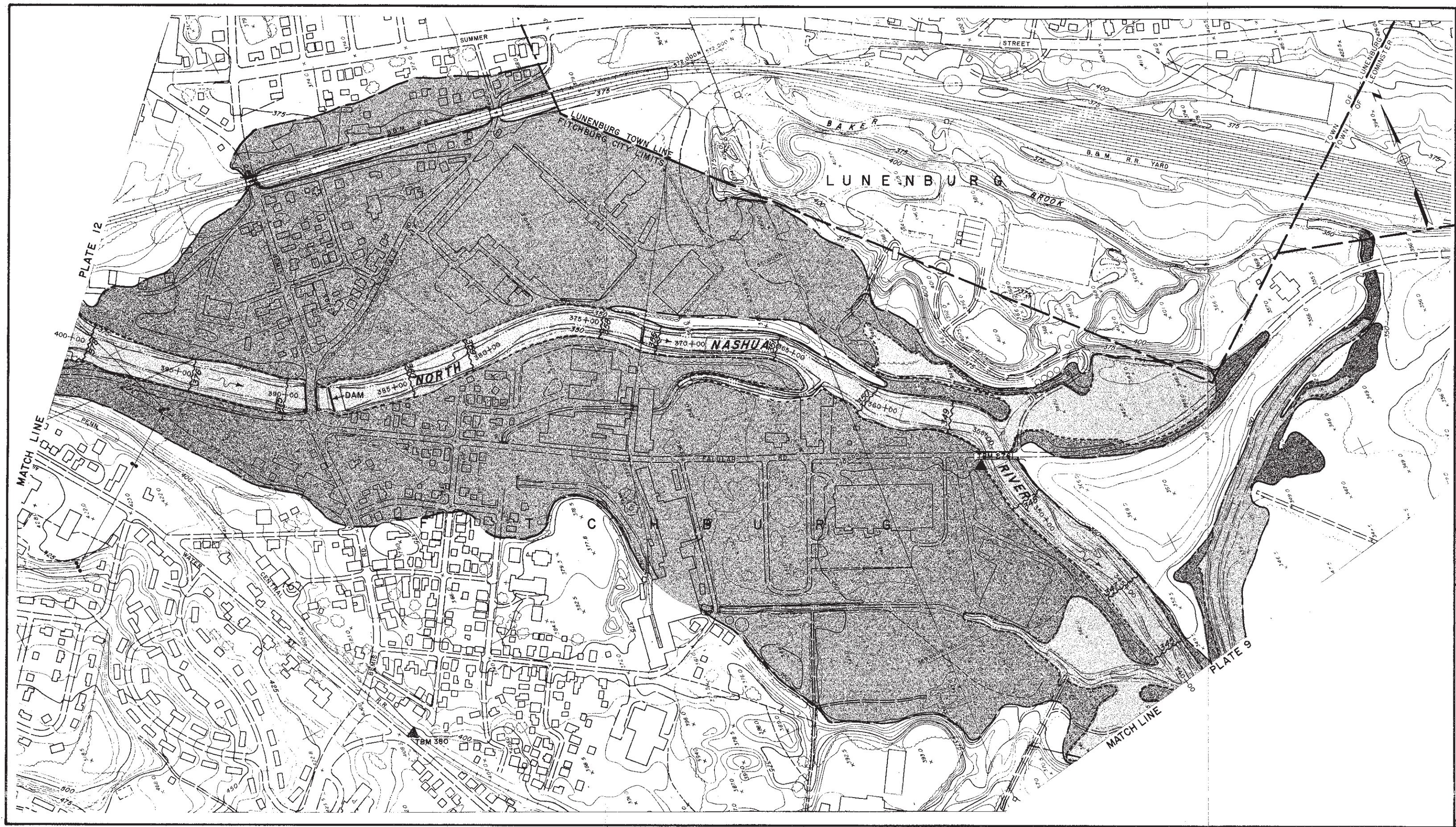
STA 280+00 TO 340+00

APRIL 1977

DEPARTMENT OF THE ARMY

NEW ENGLAND DIVISION, CORPS OF ENGINEERS

WALTHAM, MASS.



LEGEND

OVERFLOW LIMITS

CHANNEL 100 YEAR FLOOD STANDARD PROJECT FLOOD

100 YEAR FLOOD ELEVATION

370+00 STA IN FEET ABOVE LEOMINSTER-LANCASTER LINE

375 GROUND ELEVATION IN FEET (U.S.C.&G.S.) SEA LEVEL DATUM

TOWN LINES

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FLOOD PLAIN INFORMATION

FITCHBURG AND LEOMINSTER

MASSACHUSETTS

NORTH NASHUA RIVER

FLOODED AREAS

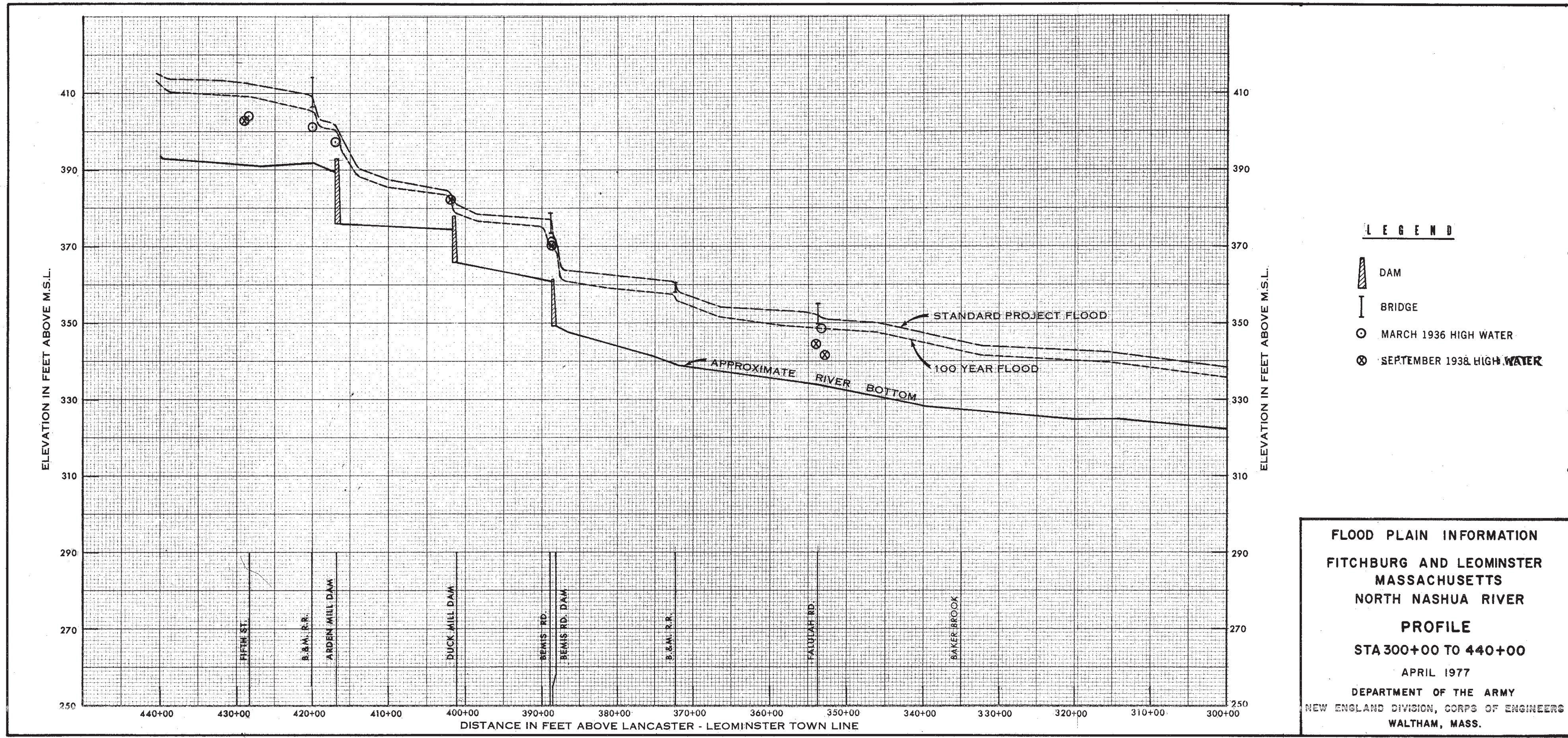
STA 340+00 TO 400+00

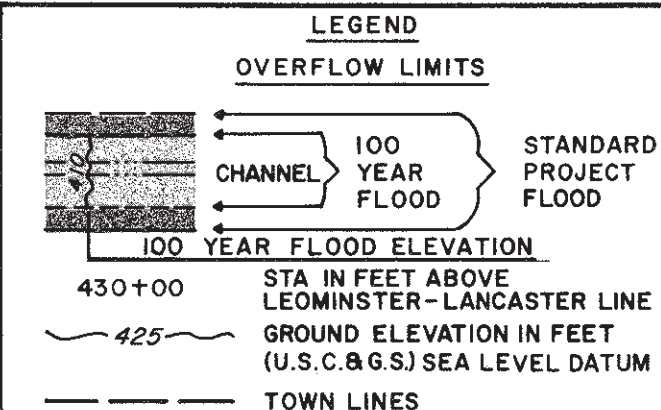
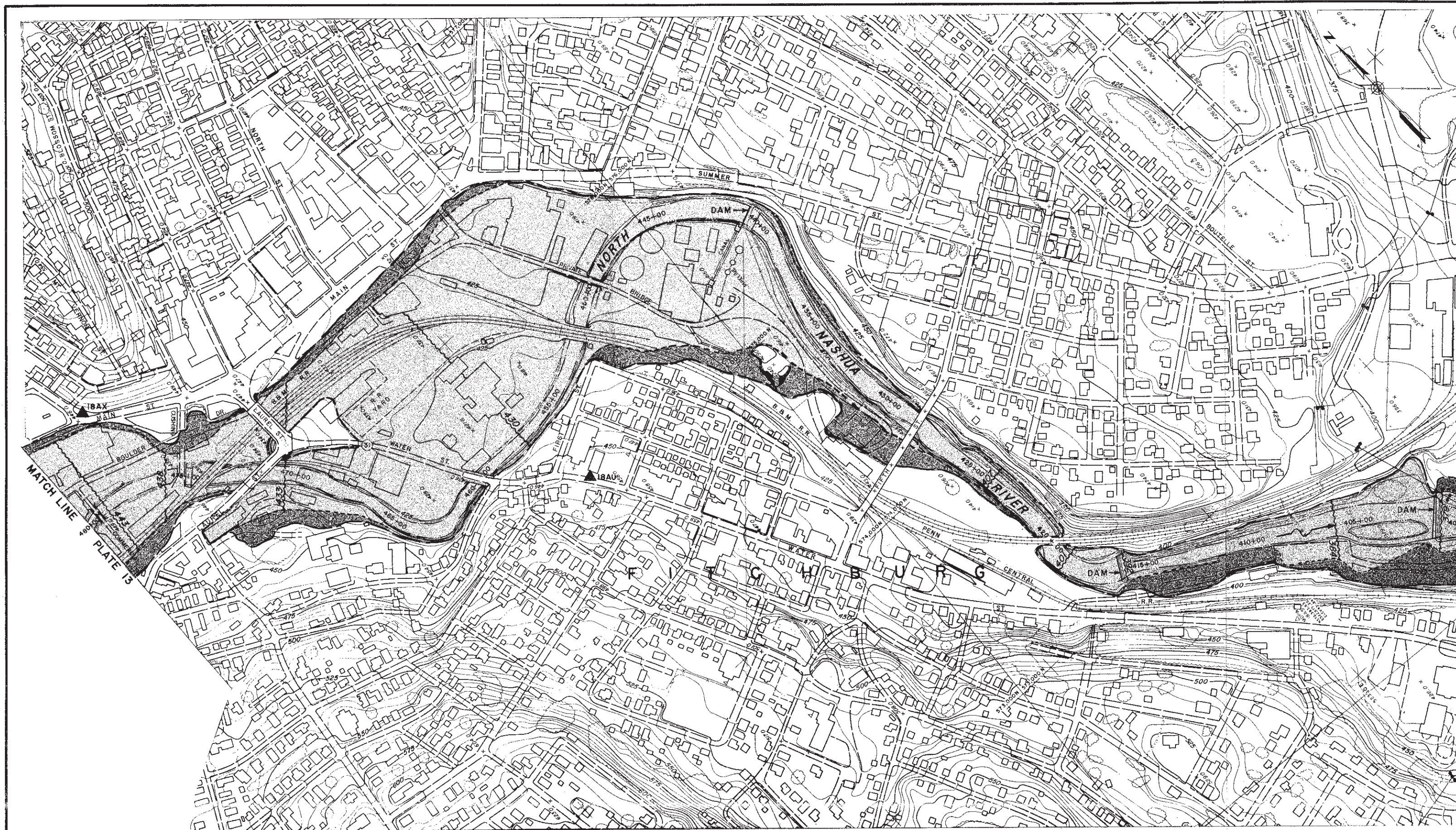
APRIL 1977

DEPARTMENT OF THE ARMY

NEW ENGLAND DIVISION, CORPS OF ENGINEERS

WALTHAM, MASS.





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FLOOD PLAIN INFORMATION

FITCHBURG AND LEOMINSTER

MASSACHUSETTS

NORTH NASHUA RIVER

PLAN

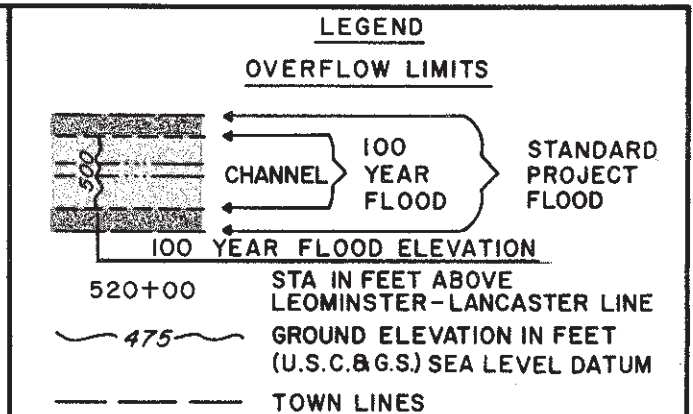
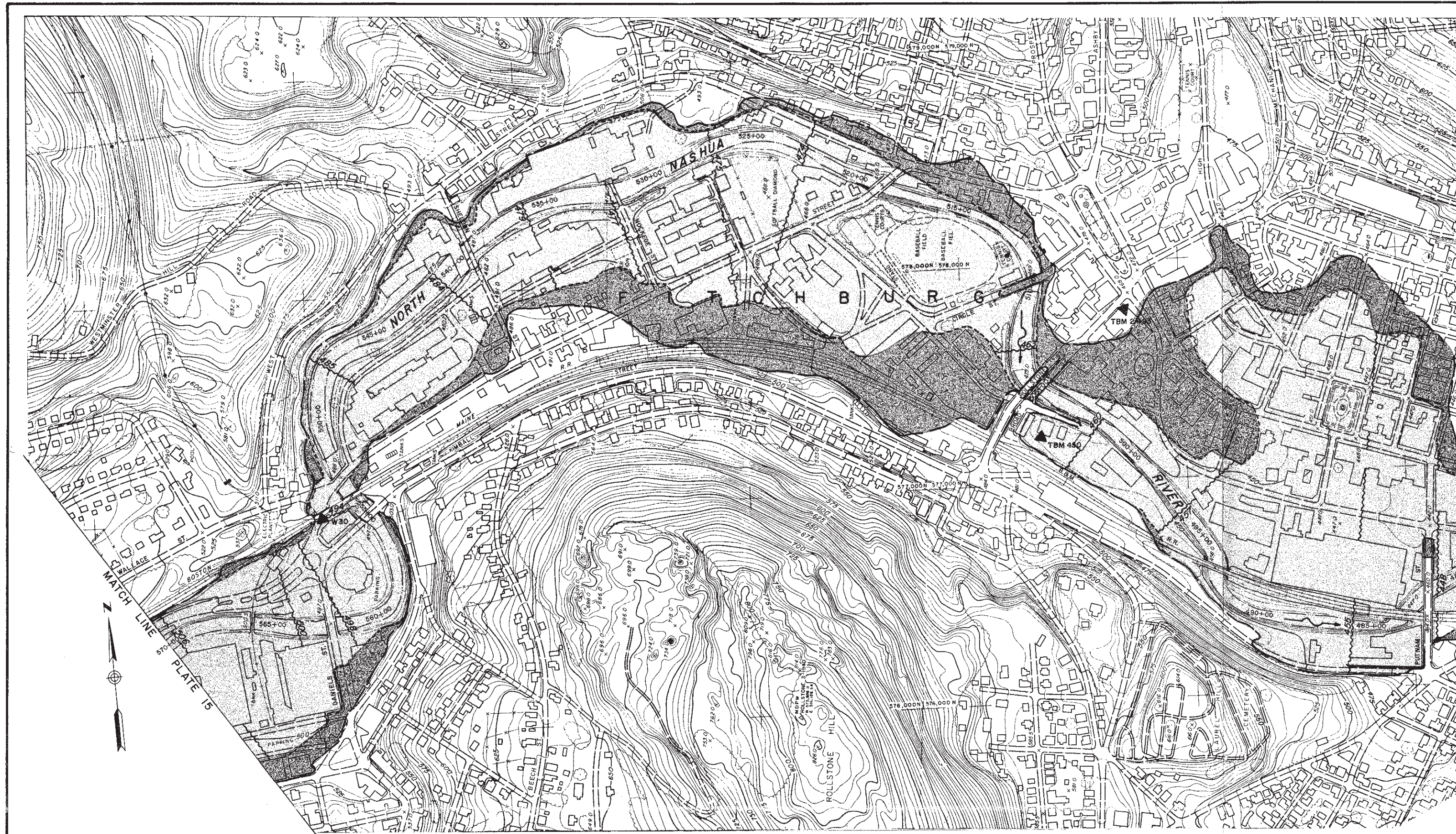
STA 400+00 TO 480+00

APRIL 1977

DEPARTMENT OF THE ARMY

NEW ENGLAND DIVISION, CORPS OF ENGINEERS

WALTHAM, MASS.



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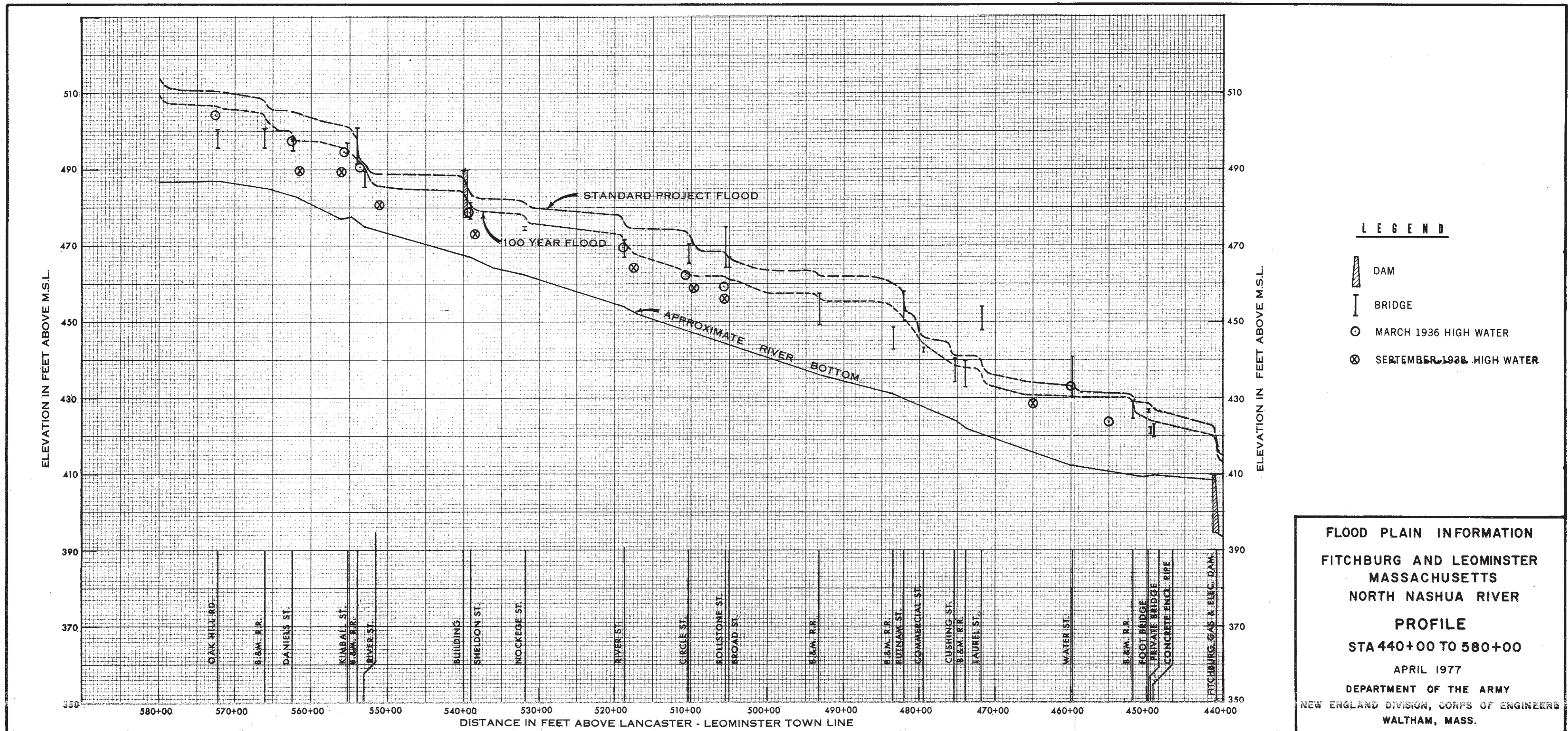
FLOOD PLAIN INFORMATION

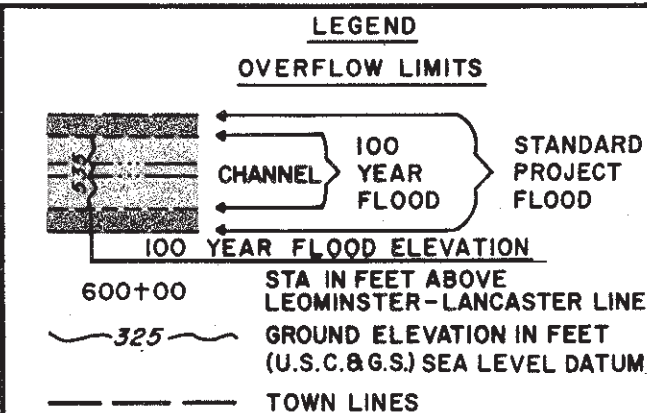
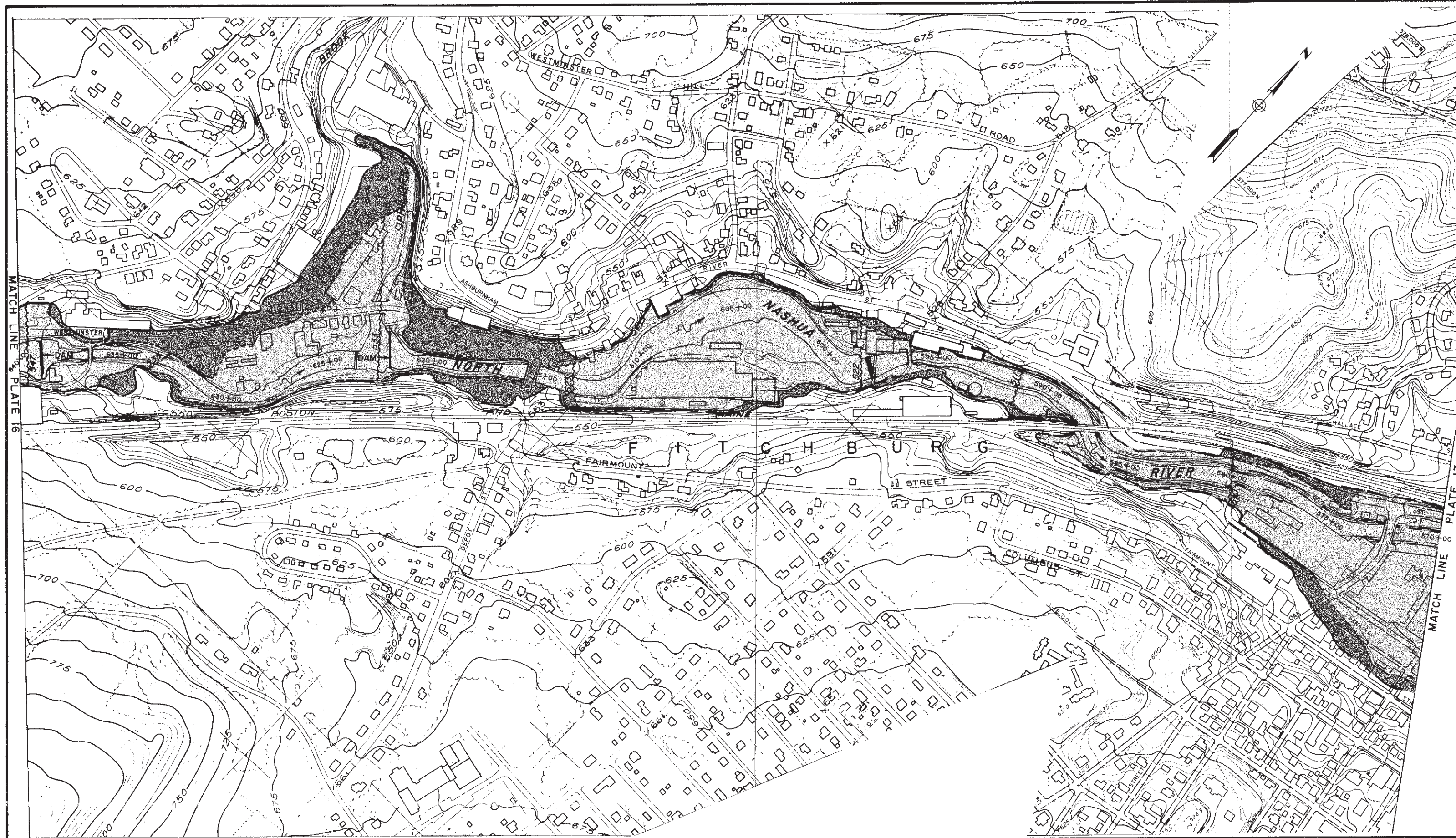
FITCHBURG AND LEOMINSTER
MASSACHUSETTS
NORTH NASHUA RIVER

FLOODED AREAS
STA 480+00 TO 570+00

APRIL 1977

DEPARTMENT OF THE ARMY
 NEW ENGLAND DIVISION, CORPS OF ENGINEERS
 WALTHAM, MASS.





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FLOOD PLAIN INFORMATION

FITCHBURG AND LEOMINSTER

MASSACHUSETTS

NORTH NASHUA RIVER

FLOODED AREAS

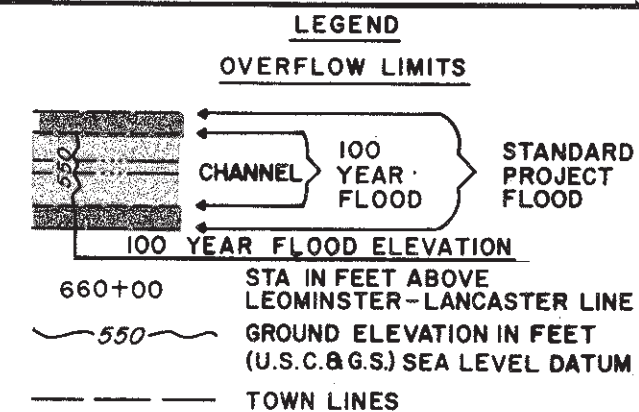
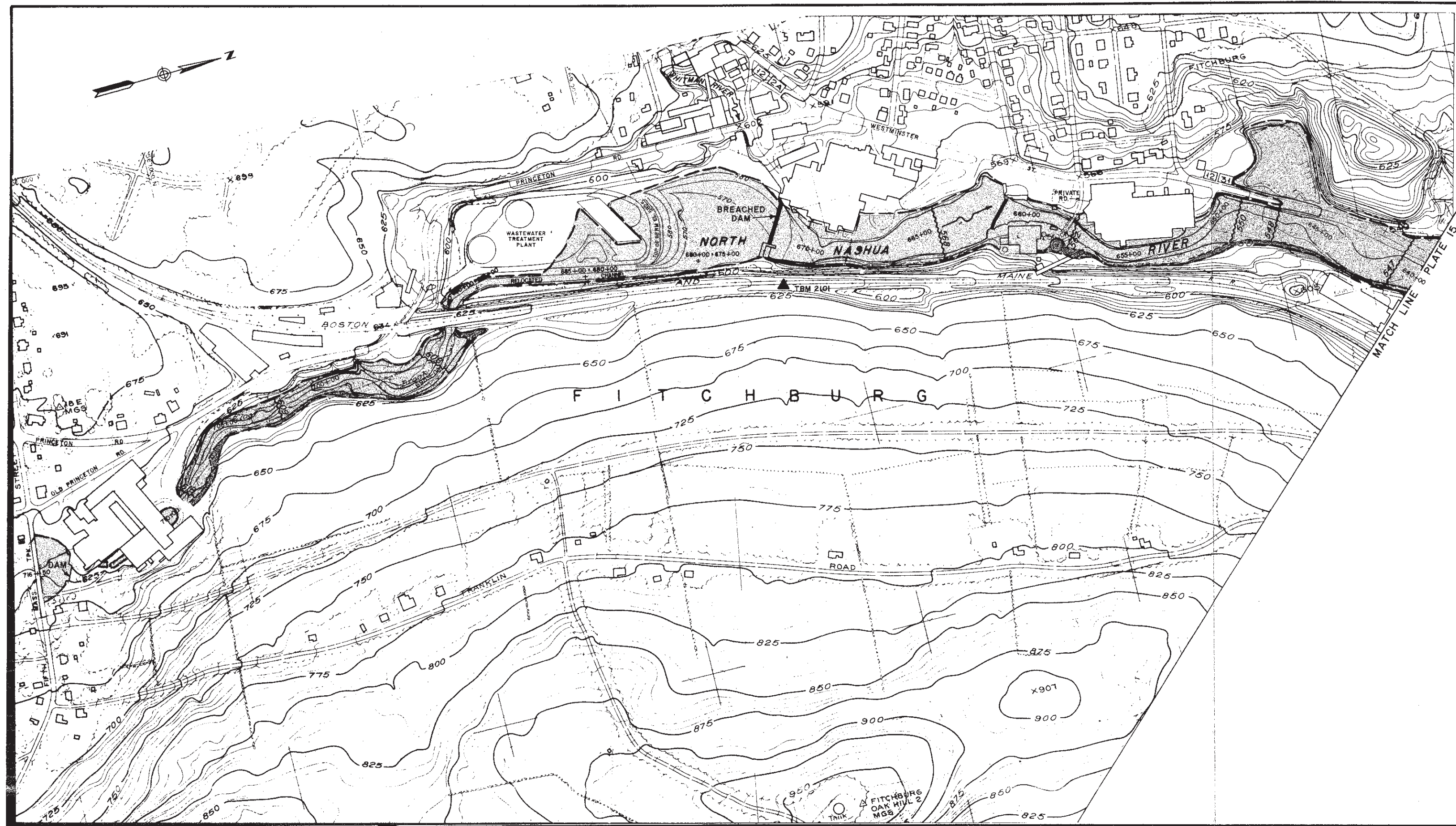
STA 570+00 TO 640+00

APRIL 1977

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WALTHAM, MASS.



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FLOOD PLAIN INFORMATION

FITCHBURG AND LEOMINSTER

MASSACHUSETTS

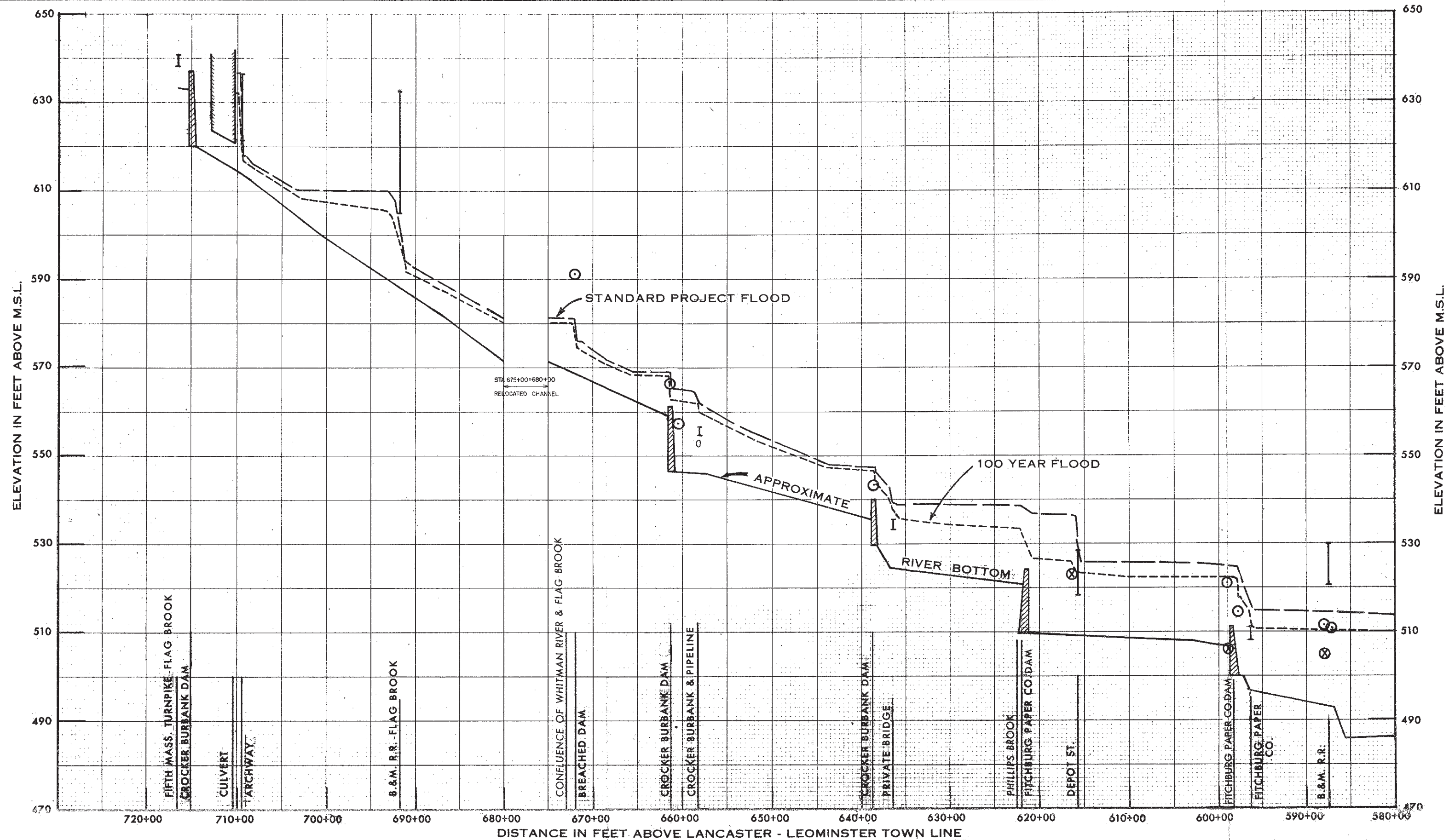
NORTH NASHUA RIVER

FLOODED AREAS

STA 640+00 TO 716+50

APRIL 1977

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FLOOD PLAIN INFORMATION
 FITCHBURG AND LEOMINSTER
 MASSACHUSETTS
 NORTH NASHUA RIVER
 PROFILE
 STA 580+00 TO 730+00
 APRIL 1977
 DEPARTMENT OF THE ARMY
 NEW ENGLAND DIVISION, CORPS OF ENGINEERS
 WALTHAM, MASS.

ELEVATION REFERENCE MARK DATA

<u>Reference Mark Number</u>	<u>Plate Number</u>	<u>Elevation</u>	<u>Description</u>
<u>Bench Marks Confirmed in Study Area</u>			
A22	7	376.846	A standard brass bench mark disk stamped "A22 1959", set in a drill hole on the northwest concrete wingwall of steel girder railroad bridge crossing over Main Street, Leominster.
TBM 2761	10	350.97	Located at bridge crossing of Falulah Road over North Nashua River - a chiseled square in the northwest granite abutment in the extreme west end of the top granite stone, Fitchburg.
TBM 380	10	401.149	A chiseled square in east end of north corner of south retaining wall of a 3' x 7' culvert under Penn Central Railroad tracks, 341 feet south (along rail) of intersection of Bemis Road and railroad tracks and 6.8 feet west of west rail, Fitchburg.
18AX	12	450.444	A 1/4 inch brass pin in a Fitchburg city bound set one foot below the surface of the sidewalk under a metal cover marked "city bound", located on the northeast corner of Prichard and Main Streets.
18AU	12	458.548	Located on the east side of Water Street, directly in front of the Rectory of Saint Bernard's Church, one foot from the curb and 5.6 feet from a granite city bound located beside the concrete walk leading to the Rectory. A U.S.C. & G.S. and State Survey disk stamped "18AU-458.548", set in a concrete monument flush with the surface of the concrete sidewalk.
TBM 450	13	454.268	A copper plug set in east corner of concrete apron at center entrance on southwest side of Fitchburg Public Works Department Garage on Broad Street.
TBM 2493	13	471.40	A brass screw set in the northwest corner of the Calvinistic Church in granite water table at the junction of Rollstone and Main Streets, Fitchburg.
W30	13	499.210	A chiseled square, southwest corner, top course, south wingwall, east abutment, Boston and Maine Railroad Bridge 50.83 over River Street, Fitchburg.
TBM 2101	16	612.73	A copper plug in the northwest corner of south footing at Boston and Maine Signal Bridge 52/79 opposite the Crocker-Burbank Paper Company's Mill 7, Fitchburg.

Bench Marks Reported in Study Area

M-12-AL	--	367.535	A U.S.C. and G.S. and State Survey standard disk set flush with ground; 321 feet west of the intersection of Florence Street and Viscoloid Avenue on top of a slight rise opposite the end of Dudley Street, Leominster.
V30	--	528.046	Chiseled square on southeast corner, top course, southeast wingwall, northeast abutment, Boston and Maine Railroad Bridge 51.33 over North Nashua River in Fitchburg.
18BA	--	482.029	A U.S.C. and G.S. and State Survey disk located .62 mile west of Fitchburg Center on the south side of Main Street, directly in front of Socony gas station, opposite triangular grass plot in Upper Common.
X18J	--	723.767	A U.S.C. and G.S. and State Survey disk located in Fitchburg on the north side of Route 2, 121.6 feet southeast of southeast leg of N.E. power tower #323, Fitchburg.

Datum is 1929 Mean Sea Level

FLOOD PLAIN INFORMATION
FITCHBURG AND LEOMINSTER
MASSACHUSETTS
NORTH NASHUA RIVER
ELEVATION REFERENCE
MARK DATA
DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASSACHUSETTS
APRIL 1977